THE ILLUMINATING ENGINEER

LIGHT
LAMPS
FITTINGS
AND
ILLUMINATION

THE JOURNAL OF
GOOD LIGHTING

Official Organ of the Illuminating Engineering Society

FOUNDED IN LONDON 1908

Edited by
J. STEWART DOW

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GAS
ELECTRICITY
ACETYLENE
PETROL-AIR
GAS
ETC.

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Special Features:

The Lighting of Textile Works—Street Lighting Experiments in South London—Lighting at the Ideal Home Exhibition—The First Annual Conference of the Master Sign Makers' Association—The Artificial Lighting of a Football Ground—News from Abroad, etc.

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The Lighting of Textile Mills

IT is now a number of years since the Illuminating Engineering Society had a paper dealing with textile lighting, the last occasion, we believe, being in 1924, when papers were presented by Mr. E. L. Oughton, who dealt with gas lighting, and Mr. P. J. Waldram, who dealt with natural lighting.

Mr. Anderson's paper, presented at the last meeting of the Society on March 25th, was confined to electric lighting but it covered the ground in a very comprehensive manner. The description of the varied and complex processes in the textile industry was itself educational, and the paper was illustrated by a number of informative diagrams and photographs of actual installations. The first point that strikes one is the magnitude of this industry which, according to the latest returns, employs something like 800,000 people. The data collected by the author led to the inference that not more than 5 per cent. of mills are really lighted, certainly a low percentage for such an important industry. The unfortunate depression in this industry no doubt furnishes one of the chief explanations. Under present conditions the management are naturally reluctant to undertake new expenditure. Yet we believe that the concerted efforts that are now being made to bring manufacturing conditions up to date will ultimately result in a general movement towards better illumination. Another circumstance that tends to hinder progress is doubtless the practice of generating electricity for lighting purposes from a dynamo driven from one of the main steam engines operating the manufacturing plant. Generators are not infrequently fully loaded and any extensive improvement in lighting would involve new plant. In many cases wiring is obsolete and ill adapted to carry more current. Really satisfactory lighting would mean rewiring and re-equipment, naturally a heavy item for a mill that is scarcely paying its way.

These difficulties should be borne in mind by enthusiasts for better lighting. At the same time good illumination is so obviously important for the intricate textile processes—for example, in lessening the time during which looms may stand idle owing to broken warps or weft threads or shuttle-changing—that every effort should be made to eliminate obvious defects. It is significant that many firms are prepared to spend considerable sums on welfare work. The provision of efficient lighting should surely be one of the first points to be considered in relation to the safety and well-being of operators.

Many of the defects in lighting illustrated in Mr. Anderson's slides were of an elementary character. One observes the use of unscreened and glaring lamps, the assignment of incorrect positions for lighting points, and the neglect of cleaning which must lead to a considerable waste of light. Generally speaking the order of illumination suggested by Mr. Anderson for various processes does not seem excessive; in other more flourishing industries higher values are usual. One point of considerable importance is the occasional use of very dark materials, which emphasizes the need for a generous allowance when the original illumination is determined. Mr. Anderson seemed to suggest that the majority of processes could be effectively lighted by general or localized general lighting. In visits to textile factories, however, it has sometimes struck the author that it was by no means easy to convey the light to the exact point where the illumination is needed. It would seem that in textile processes we have a possible outlet for the idea of incorporating special lighting units in the design of the machine—as was illustrated in a recent display at the combined exhibition of the Physical and Optical Societies.

It was perhaps natural that in the discussion of Mr. Anderson's paper considerable prominence should be given to the choice of artificial daylight systems. It is evident that in certain processes colour-discrimination is of considerable importance. There were some who contended that the ordinary "daylight-blue" lamps were unsuitable for these processes, whereas others expressed the belief that such lamps, although insufficiently accurate for expert colour-matching work, would answer the ordinary requirements of the textile industry. One recognized the convenience of lamps with bulbs of bluish glass for installations where only a visual match with daylight is desirable, yet it has always seemed to the writer that where any high degree of discrimination of colours is called for such lamps are at a disadvantage as compared with units equipped with colour-filters—if only for the reason that in the latter case the filter can be designed solely with a view to colour-effects. We agree, however, that, as Mr. C. C. Paterson mentioned, there is a good deal of confusion in regard to lighting for colour-processes. No doubt the artificial daylight committee recently appointed by the Illumination Section of the B.E.S.A. will elucidate this problem.

Street Lighting Experiments in South London

THE enterprising departure of the Lewisham Borough Council in arranging for practical demonstrations of street lighting by the South Metropolitan Gas Company and the South Metropolitan Electric Light and Power Co. has attracted a considerable amount of attention. From South Catford the main Hastings Road is lighted for one mile by high-pressure gas lamps, centrally suspended 50 yards apart. Along a subsequent mile electric lighting units have been installed, the lamps being mounted 18 feet high and placed alternately on opposite sides of the road. The installation was recently inspected by representatives of the Ministry of Transport, street-lighting authorities and representatives of bodies interested in motor transport; several well-known motorists were included in the party. From the opinions attributed to visitors in the Press, there would seem to be an inclination on the part of motorists to prefer the centrally suspended lights. Earl Howe considered this system of lighting the better, irrespective of the rival merits of electrictiy and gas. It was urged the light was better diffused, and better adapted to the observation of approaching vehicles, and that the central row of lights furnished a useful indication of direction to motorists in the event of a fog. Members of the Works and Highways Committee of the Lewisham Borough Council have also inspected the exhibit, though, at the time we write these words, no decision has been announced.

Owing largely to the public interest excited by this demonstration the Works Committee have deferred their judgment on the two installations, and meantime, in an interim communication, have expressed their appreciation of the manner in which both installations have been carried out.

The organization of practical demonstrations such as this is a useful departure, and the impressions recorded above show how much depends on the arrangement of the lights, whether gas or electric. It has been stated that the cost of installation and maintenance is about the same in both cases.

In the past, decisions in regard to street lighting have been too often based almost entirely on comparative cost, and it is encouraging to find a case in which more consideration is being paid to the *effect*, and expert opinions are being invited. It is possible that other lighting authorities will be encouraged to conduct fuller experiments before decisions are taken, though we are not sure that isolated investigations throughout the country constitute the best way of attacking the problem.

On the present occasions we gather that only two alternative systems have been installed. There are, however, other possible methods, both gas and electric. One could hardly expect individual lighting authorities to undertake such an elaborate series of tests as that arranged at Sheffield in 1928. But if a permanent exhibit, continually kept up to date, could be organized at some convenient centre this might be of great benefit to lighting committees throughout the country. In the case of a permanent demonstration of this kind it should be possible to watch carefully the influence of various systems of lighting on traffic under different weather conditions and to carry out sustained tests. Incidentally, the existence of the display would have considerable educational value and would lead the public to take more interest in the lighting of their streets.

Lighting at the Ideal Home Exhibition

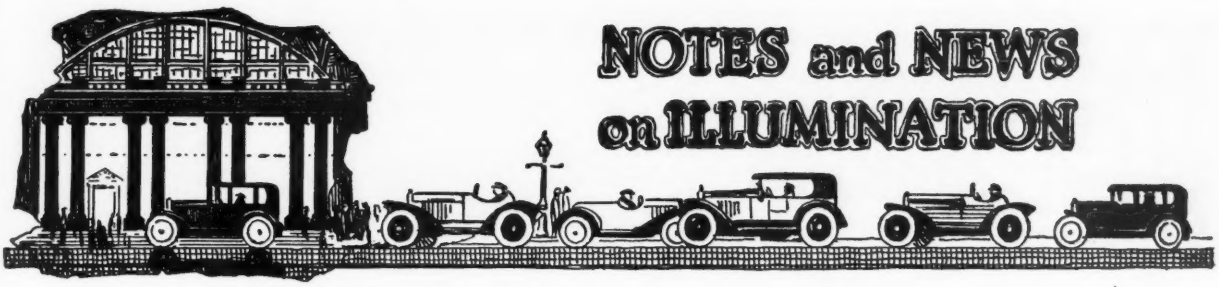
WE give elsewhere a general survey of the lighting arrangements at this exhibition—one of the most popular annual events of the kind. One formed the impression that the general standard of lighting stalls was vastly better than was usual at exhibitions in the past. Concealed lighting was almost invariably adopted, and whilst there was general uniformity in the observance of fundamental principles exhibitors were allowed latitude in contriving distinctive effects. In commenting on exhibitions a few years ago, we repeatedly urged the need for some general acceptance of a few general principles, such as would eliminate the distressing display of glaring sources and misplaced lights; happily a better recognition of such principles seems to have been brought about, for there were few instances of glare.

It was also gratifying to observe what an important part light played throughout the exhibition, both in accentuating and displaying objects shown, and as an indispensible element in the "Ideal Home." We can recall other exhibits of model homes which were equipped with many ingenious labour-saving devices, but where the possibilities of artificial lighting were by no means properly exploited. On this occasion, so far as one could judge from a general inspection, domestic lighting was much better treated. In most cases the lights were at least adequate and well-shaded, and in some cases contributed much to the charm of the interior. As the various modern model homes were original in design it was not surprising to find "architectural lighting" in evidence. Many of the devices described under this head are effective besides being novel, and will doubtless become familiar in the home; the future of others of a more spectacular kind is more problematical, but even here one sees evidence of enterprise and a desire to experiment that is welcome.

Visitors were naturally attracted by the original lighting displays in the Pavilion of Light and adjacent exhibits. The ideas illustrated in the lounge, nursery and bedroom, all of which were pleasing in conception, well deserve study and might be adopted, with modifications, in many homes. The dining room was admittedly particularly daring in conception. Not all of us would feel disposed to copy this in our own homes, but it was a highly original conception and an effective demonstration of what can be achieved in the spectacular use of artificial light.

We would also like to commend the display of the London Gas Exhibit Committee, which, if more restrained, furnished an admirable example of the decorative possibilities of modern gas lighting. In view of our remarks on the need for enterprise in this field in our last issues, we gladly take the opportunity of congratulating the Committee on their display at the Ideal Home Exhibition.

One thing the exhibition will surely have done—stimulated public interest in the possibilities of artificial lighting. The lighting section was doubtless one of the most popular in a well-attended exhibition. Visitors have doubtless learned to appreciate not only what an important part lighting plays in promoting the comfort in the home, but how much can be done by its aid to render an interior interesting and attractive.



The Daylight Factor

A point of some importance in connection with measurements of daylight is raised in a recent communication from the Department of Scientific and Industrial Research. Access of daylight into a building is necessarily expressed as a ratio between the internal illumination and the illumination out of doors, but in the past two distinct quantities have been used. The first of these is the "daylight factor," which is the ratio of the internal illumination to the illumination of a horizontal surface exposed to a hemisphere of sky, and the "sill ratio," which is the ratio of the internal illumination to the illumination of a horizontal surface exposed to one quarter-sphere of sky (i.e., the illumination received by a horizontal surface placed on a window sill, assuming that there are no adjacent buildings or other objects which obstruct the sky). It was originally stated that the second of these ratios, which is double the first, would be used in the series of Technical Papers on Illumination Research, issued by the Department of Scientific and Industrial Research. But subsequently, in 1929, international agreement to use the daylight factor was attained. Accordingly this ratio will be used in all future reports. It may be noted that the only publications in which the sill ratio has been used are those dealing with "The Natural Lighting of Buildings" (Technical Paper No. 6), and "Penetration of Daylight and Sunlight into Buildings (Technical Paper No. 7).

A Conference on Signs

An event of considerable interest was the first annual conference arranged by the Master Sign Makers' Association, at the Holborn Restaurant, on March 28th. After the conference had been opened by Mr. Arthur Chadwick papers were read by Mr. F. G. Sayer ("Modern Methods of Sign and Glass Writing"), Professor H. Robertson ("Signs in Relation to Architecture"), and Mr. J. M. Woolnough ("The Application of Electricity to Signs"). All three papers were interesting and gave rise to a good discussion. Mr. Sayer contributed some sound advice on the materials most suitable for glass writing. Professor Robertson raised several points of considerable importance, such as the adoption of fewer and better signs, the avoidance of a medley of designs, each of which interferes with the effect of another, and the desirability of architects making provision for signs when designing plans of commercial buildings. There is indeed need for effort to give the illuminated sign a definite place in the architectural scheme; at present it is too often an excrescence. Mr. Woolnough's paper also contained many excellent suggestions. His comments on local regulations deserve special notice. Each locality imposes special regulations, sometimes framed many years ago, and attempts to comply with these may cripple design unnecessarily and consume an immense amount of time. One fact he mentioned, that in in London the Sky Sign Act does not allow signs to project more than three feet above the roof, in itself suffices to illustrate the vast difference between conditions here and in such a city as New York. We note with pleasure the success of this first annual conference of the Master Sign Makers' Association, which, like the Association of Public Lighting Engineers, must in future be reckoned as a body dealing with a specialized field of illumination which members of the Illuminating Engineering Society cannot afford to overlook.

The Electrical Association for Women

FIFTH ANNUAL CONFERENCE.

We have before us the programme of the fifth annual conference of the Electrical Association for Women, which is to be held in London during May 15th and 16th. The arrangements on the opening day include a luncheon at the Park Lane Hotel, a visit to the Home Office Industrial Museum, where the members will be received by Miss H. Martindale (H.M. Deputy Chief Inspector of Factories), and a reception at the Institution of Electrical Engineers, when Mr. Llewellyn B. Atkinson will give a talk on "Some Electrical Reminiscences." The morning of Friday, May 16th, will be devoted to a visit to the factory of Messrs. J. Lyons & Co., at Greenford, and in the evening there will be a ball and cabaret show at the Park Lane Hotel. The programme thus effectively mingles instruction and entertainment.

The Illumination of the Regent's Canal Dock

We observe that the Regent's Canal Dock, Limehouse, furnishes one of the latest examples of industrial floodlighting. The installation has transformed the lock entrance into a bright "white-way." Ships laden with coal required by the big London gas and electrical undertakings, which have to be discharged as speedily as possible, can now be dealt with by night. All the coal that arrives in the Regent's Canal Dock has to be transferred to barges, which carry it to the various industrial concerns by way of the Grand Union Canal. Hence the evident need of effective illumination at night. One only wonders that it was allowed to be shrouded in darkness for so long.

Information on Accidents due to Inadequate Illumination

We may, perhaps, without forestalling the Report of the Council of the Illuminating Engineering Society for the past session, reveal the fact that the Council has recently formed a "Technical Committee." This Committee, which is under the chairmanship of Mr. A. W. Beuttell, will deal with any technical problems presented to it, and has the special task of investigating methods of making known the principles of good lighting and the ensuing benefits. The Committee has been busily engaged in reviewing its programme, and has already mapped out a comprehensive scheme of work which should find occupation for many other members of the Society. For the moment we are asked to mention one special task which the Committee has set itself, the collection of information illustrating the relation between good illumination and safety—whether in factories, in streets or in public places. Mr. G. H. Wilson (G.E.C. Research Laboratory, Wembley) has kindly consented to act as supervisor of this work, and will be glad to receive any information that members or others can send him bearing on this topic. We imagine that many of our readers may have had personal experiences of accidents or mishaps caused by inadequate lighting, or may be aware of useful statistical data bearing on this subject. If they would get in touch with Mr. Wilson their assistance would be very welcome.

Illuminated Signs at German Railway Stations

The account of American installations noted above might be paralleled by the series of descriptions of noteworthy lighting installations in Berlin, which has recently been appearing in *Licht und Lampe*. One of the most recent of these surveys the illuminated signs introduced by most of the railway stations in Berlin. In addition to the adoption of floodlighting in station courtyards, names of stations are now prominently displayed in bold illuminated letters which cannot be mistaken by the stranger. Another novelty has been the increasing use of translucent maps, illuminated from behind. One of these is in effect a railway map of Europe showing all the connections to adjacent countries and the near east. Yet another device is a luminous panel which besides showing the time and departure and destinations of trains reveals the number of sleeping berths still free. It would appear that these methods are characteristic of most of the chief stations in Berlin. In London the need for bolder illuminated signs indicating the existence of some stations is still felt, though admittedly there has been a great improvement during recent years. Much more might be done to educate the public by means of illuminated large scale maps showing the ramifications of railway systems. The illuminated tube-system shown at Charing Cross underground station has done good work for some years. Yet one observes that it is still studied zealously by visitors.

The Lighting of the San Francisco Stock Exchange

In the *Transactions* of the Illuminating Engineering Society for March the series of illustrated descriptions of architectural lighting installations is continued. Perhaps not all of these deserve to be regarded as true examples of architectural lighting, but all are interesting, and the account of the treatment of the San Francisco Stock Exchange especially so. This building is 122 ft. long and 68 ft. wide with a 40 ft. ceiling. The general lighting is furnished by a panel 109 ft. long and 39 ft. wide which consists of an arrangement of crystallized finished metal fins, above which are hammered slightly diffusing glass panels. Above this artificial skylight are mounted fifty-five 740-watt lamps and twenty 300-watt lamps in prismatic glass reflectors with aluminium covers. This installation was designed to produce a floor illumination of 25 foot-candles. Recent tests indicate an average value near 30 foot-candles. In addition special arrangements are made for the illumination, by means of trough units, of the large vertical boards used to carry quotations which must be capable of being read from a long distance. The illumination provided on these duplicate boards, 92 ft. long, 8 ft. high and mounted 9 feet above the trading floor on either side of the hall, varies from 80 foot-candles at the top to approximately 40 foot-candles at the bottom. The illustrations shows that there is clear view down the entire length of the hall. The values of illumination provided are certainly impressively high. One wonders how the lighting arrangements at the London Stock Exchange would compare with this installation!

An Illuminating Engineering Society in France

We note with pleasure the announcement in *Lux* of the formation of an Illuminating Engineering Society in France, under the presidency of M. Maurice Leblanc, who outlined the aims and objects of the new body at a luncheon given on March 19th. In his address M. Leblanc remarked that there were in existence a number of bodies, such as the *Comité National Français de l'Eclairage et du Chauffage*, the *Société Française des Electriciens*, and the *Société du Gaz*, which have individually done much for illumination. Yet each of these has had a somewhat limited field of work, and the number of active workers able to devote much time to the cause of better lighting was in each case small. Hence the desirability of fusion of effort and the creation of the new body, the *Société des Ingenieurs de l'Eclairage*. M. Leblanc is being aided by a representative committee, on which the bodies named above are represented. The present address of the Society is 4 rue du Dôme, Paris (16*e*). It has often occurred to us that the formation of an Illuminating Engineering Society in France was only a matter of time, and we wish the new body every success.

The Amsterdam Edison Light Festival

Through the courtesy of Messrs. N. V. Philips Gloeilampenfabrieken we have received a descriptive account of the festival of light arranged in Amsterdam during October 21-26, 1929. The description gives an admirable insight into the conditions necessary for success in an effort of this kind, and would well deserve study by any body contemplating the organization of a light festival. There are one or two lessons which might well be emphasized. In the first place the aid of all firms and bodies concerned in furnishing artificial light must naturally be obtained, for on them will fall the main burden of arranging the entertainment. But this in itself is not sufficient. The idea cannot be presented solely by lighting concerns. It is necessary to get the goodwill of the local authorities and the chief trading and other social organizations and to let them share in the work—so that ultimately the display becomes the creation of all sections of the inhabitants, in which they feel a civic pride. The actual lighting demonstrations should be varied. They should include such items as floodlighting, decorative displays of light, special street lighting and shop window lighting, demonstrations of sports by artificial light, and miscellaneous features such as luminous fountains, parades of illuminated boats and motor-cars, etc. Special events should be spread throughout the week so as to maintain interest. The effort should embrace the whole town, i.e., the interest of outlying districts must be excited by arranging special demonstrations in their areas as well as in the centre of the town. The booklet is illustrated by numerous photographs of striking lighting installations, a map of Amsterdam showing the sites of various lighted objects, and an informative table showing the expenditure of energy on each item. We may conclude by quoting the advice that a light festival is not worth organizing unless full and sympathetic support can be obtained and the financial foundation firmly laid. "Drop the idea if you can only arrive at a compromise."

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

The Lighting of Textile Mills

(Proceedings at the Meeting of the Illuminating Engineering Society held in the Lecture Theatre of the Home Office Industrial Museum, Horseferry Road, Westminster, S.W.1, at 6-30 p.m., on Tuesday, March 25th, 1930.)

A MEETING of the Illuminating Engineering Society was held in the Lecture Theatre of the Home Office Industrial Museum (Horseferry Road, Westminster, S.W.1), on Tuesday, March 25th. Members assembled for light refreshments at 6-30 p.m., and the meeting opened at 7 p.m., when the PRESIDENT (Dr. J. W. T. Walsh) took the chair.

After the minutes of the last meeting had been taken as read, the HON. SECRETARY announced the names of the following applicants for membership:—

Groom, H. R. L. Lester, The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

Millner, W., B.Sc., A.M.I.E.E. Development Engineer, Westminster Electric Supply Corporation Ltd., "Kismet," Ember Lane, East Molesey, Surrey.

The names of applicants presented at the last meeting were read again, and these gentlemen were formally declared members of the Society.*

The PRESIDENT then called upon Mr. S. ANDERSON to read his paper on **"The Lighting of Textile Mills."** The author pointed out the magnitude of the industry, which employs nearly 800,000 operators, and remarked that probably not more than 5 per cent. of mills can be considered well lighted at present. A considerable number of mills generate their own electricity, and there is often reluctance to increase the lighting load. The various processes in textile mills were described, and the lighting conditions discussed by the aid of numerous lantern slides showing actual installations. Tables were presented showing suggested values of illumination for various processes, and attention was drawn to the need for higher illuminations when dark materials were being treated. Reference was also made to the use of artificial daylight for processes involving discrimination of colour values. Looms may be stopped for as much as 30 per cent. of the working period, owing to broken warp or weft threads or shuttle changing. During such periods the weaver is in special need of good illumination, and there is little doubt that the duration of such stoppages is reduced when the lighting conditions are satisfactory.

An interesting discussion ensued in which the following took part: Mr. F. L. OUGHTON, Mr. J. L. H. COOPER, Capt. E. J. HALSTEAD HANBY, Mr. H. H. LONG, Mr. T. E. RITCHIE, Mr. C. C. PATERSON, Mr. J. S. DOW and Mr. W. J. JONES.

In the discussion general appreciation was expressed of the great amount of work involved in Mr. Anderson's paper, and the excellent survey of the textile industry which it furnished. Reference was made to difficulties caused by the deposit of fluff on lighting fittings, and to the fact that higher illuminations were needed in processes where dark materials were used. Mr. Anderson was asked to state what fraction the cost of lighting formed of the total wages bill. It was also suggested that owing to the difficulty in furnishing light at the exact point desired by means of general lighting, special units might possibly be incorporated in the design of certain machines. Much of the discussion turned on the requirements of artificial daylight units and the extent to which lamps with "daylight" bulbs could be usefully applied to the textile industry.

After Mr. Anderson had briefly replied to the various points raised, a cordial vote of thanks to him for his paper was moved by the President and carried with acclamation.

In conclusion it was announced that the next meeting would be held on Tuesday, May 6th, at the House of the Royal Society of Arts, when a paper on "Luminous Traffic Signals" would be read by Mr. T. Austin.

* *The Illuminating Engineer*, March, 1930, p. 72.

The Leon Gaster Memorial Fund

We understand that the appeal on behalf of this fund, which was launched in October last year, has met with a gratifying response, the minimum amount regarded as desirable (£200) having been exceeded. Nevertheless, as this sum was regarded as a minimum only, subscriptions from any members or friends who have not yet responded to the appeal will be very welcome. We understand that it is the intention to close the fund at the end of the present session, so that there is still an opportunity during the coming two months for subscriptions to be entered.

The fund is linked with the name of its founder, and is intended to commemorate the great services which the late Mr. Leon Gaster rendered to the Society and to illuminating engineering. But, apart from this association, its object—the award of a premium for the best contribution on illuminating engineering submitted to the Society each year—is one that ought to interest every member. We hope, therefore, that recently joined members, who may not have had the opportunity of knowing Mr. Gaster will not feel the less inclined to subscribe.

Subscriptions ranging from 5s. to £5 have been received. No member need hesitate to help if the amount he can afford is a small one. The requisite sum seems now assured. But it would be felt that the appeal had only partially succeeded if the great majority of members did not share in this effort, each according to his means.

The Lighting of Textile Mills

By S. ANDERSON, B.Sc.

(E.L.M.A. Lighting Service Bureau.)

(Paper read at the Meeting of the Illuminating Engineering Society, held at the Home Office Industrial Museum, Horseferry Road, Westminster, London, S.W.1, at 6-30 p.m., on Tuesday, March 25th, 1930.)

THERE are few industries for which the provision of suitable artificial light offers more diverse problems than those associated with the manufacture of textiles. Processes and operations from those of the roughest to those of the finest character are involved, and while in common with other industries there is a tendency towards automatic and semi-automatic machinery, yet there remains a considerable amount of work involving acute vision.

In order to obtain some idea of the magnitude of the industry whose lighting is under review, it may be of interest to record that the most recent statistics available show a total of 794,000 operatives engaged in the cotton and woollen industries alone, while there are 66 million spinning spindles and 860,000 looms installed in the mills. When it is realized that at a liberal estimate not more than 5 per cent. of textile mills can be considered as well illuminated at present, it is apparent what a large amount of work awaits the illuminating engineer in this direction once the financial position of the industry is stabilized, and, in order to study the lighting problems involved at first hand, the author spent some 10 weeks last autumn (1929) in the heart of the textile industries of Yorkshire, Lancashire and Northern Ireland. Visits were made to all types and sizes of mills, and the tables appended give in a condensed form samples of the artificial lighting intensities encountered.

While there are some mills in parts of which modern industrial lighting methods have been introduced through the perseverance of the mill engineer in worrying his management, or the progressive policy of the latter, the great majority of mills in this country are lighted in an inefficient manner with obsolete equipment. It is not necessary to go far to discover the principal reasons for this backwardness, as the extremely depressed state of the industry as a whole during the greater part of the past decade has resulted in the cutting-down of capital expenditure on mill equipment to an absolute minimum. The chief contributory causes to this seems to be lack of knowledge of the subject and lack of appreciation of the advantages of modern lighting. In this connection, it is significant that in every mill visited where a modern lighting system had been installed both the management and operatives were enthusiastic in its praise, and the former contemplated gradually extending the installation until every department of the mill was well lighted.

Quite 90 per cent. of the textile mills in this country are lit by electricity, many generating their own supply by means of a dynamo driven from one of the main steam engines, and hence the cost of power to them is negligible. They have, however, in most cases, a considerable objection to increasing their lighting load owing to the fact that their generators are already fully loaded, and any extensive improvement in lighting would necessitate the installation of a new dynamo, probably accompanied by additions to the supply cables in order to cope with the increased load. In many instances, a power allocation of as low as 1 watt to six square feet of floor area has been encountered, which makes it very evident that a considerable increase in the power available for lighting will be necessary in order to bring illumination up to a satisfactory value.

The provision for adequate daylight illumination is very variable, but in general spinning mills are poorly lighted during daylight, while weaving sheds are well lighted. The former are of the multi-storey type, and rarely have sufficient ceiling height and window area to give good illumination in the middle of the floor, while the latter are invariably saw-tooth roof-lit buildings, giving excellent lighting on the looms. Apart from any other considerations, this points to the conclusion that a considerable illumination intensity is particularly necessary for weaving, though investigation has shown that illumination does have a notable effect on spinning also, and it is not uncommon, especially during the winter months, to find spinning rooms where the lines of lights in the middle or darker regions are kept on all day.

In all sections of the industry, processes up to and including the spinning of the yarn are carried on with the material in its natural colour as a rule, and as this is nearly white except in the case of flax, where the natural colour is somewhat darker, reflection of whatever light is incident on the material is fairly good. Weaving, however, is done chiefly with dyed yarns in the Yorkshire trade, though in the cotton trade a considerable proportion of the material is woven in the natural colour or with dyed borders, while linen again is chiefly woven white or natural colour. Silk, on the other hand, is very frequently dyed before woven, though as a rule light colours predominate, many of which give very good coefficients of reflection. It is, then, usually in the woollen trade that the highest intensities for weaving are necessary.

In many processes, the size and layout of the machinery involved is fairly well standardized, so that detailed recommendations for a suitable lighting layout can be made, though other factors, such as, position of drive shafting, dust trunks and heating pipes and ceiling height, will often make minor alterations in lighting layout necessary to harmonize with individual conditions. In many cases, particularly in the woollen industry, ceiling heights are such in relation to the height of the machines that it is impossible to employ a sufficient mounting height for the lighting fittings to allow

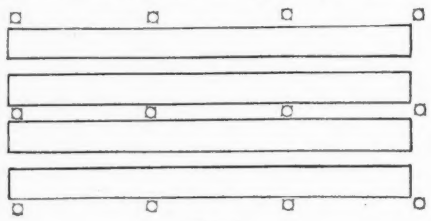


FIG. 1.

of alternate aisle spacing as in Fig. 1, and the less economical method of individual aisle location has to be employed in order to provide direct lighting on the working planes in each aisle. When new mills (of the block type) are being built, the consideration of allowing ample ceiling height for both day and artificial lighting would be well worth while.

Individual Considerations.

In dealing with individual processes and the lighting applicable to them, it is fortunate that many are very similar in the cotton, woollen and linen sections of the industry, and consequently it is possible to give many details for individual processes which will apply equally well in each section. Where, however, such grouping is not possible, it will be made clear that only one of the three sections is being considered.

It should be noted before proceeding that the B.E.S.A. standard dispersive reflector is a suitable unit for the great majority of textile mill lighting, and where no other type of unit is specified it is to be inferred that this will be applicable. In the case of 60 and 100 watt units, the pearl or opal type of lamp, which are as yet little used in the industry, seem to be the most suitable from all points of view. For larger units, opal or bowl frosted lamps provide the most suitable light from the point of view of diffusion and freedom from glare.

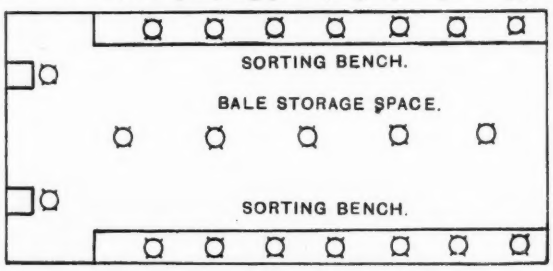
Cotton Opening and Scutching.

The earliest processes must be treated separately. In Lancashire mills the cotton is imported in bales, which are opened and freed from dust by bale-breaking and opening machines. Bales of various qualities of raw cotton from different sources are blended together before being fed to the machines, and a certain amount of colour discrimination is involved. As a rule this inspection is carried out in daylight, and the proportions determined for the rest of the day so that it is unnecessary for fine discrimination by artificial light. A daylight-blue lamp is, however, employed in this department by one or two firms, and these do make the grading possible after dark. Two or three sets of opening machinery serve a whole mill, and there is no standardized layout. A system of general lighting is applicable in the majority of cases, but this should be arranged so that no lighting units are located directly over the machines in order to ensure that there is no possibility of anything falling into them. The existing intensity with the artificial lighting installed in many mills at present is of the order of 0.5 foot-candle, but it is suggested that a minimum of 3 foot-candles should be provided to facilitate machine adjustment and inspection.

From the openers, the cotton which is now in the form of rough rolls or " laps " passes to the scutchers. These merely combine several rough laps into one, evening out inequalities in the process. Again, general lighting is applicable with the same restrictions as to the location of units, and an intensity similar to that in the opening room is suitable. The machines are fairly large (about 18 ft. by 6 ft.), but as they are not more than 5 ft. in height even narrow gangways between machines will receive adequate illumination from units about 10 ft. from the floor. The final laps from the finishing scutchers are passed on to the carding room, which will be dealt with later.

Wool Picking and Washing.

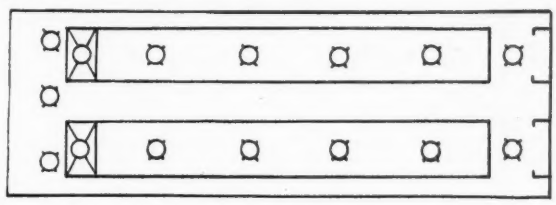
The primary processes in the woollen industry differ considerably. Bales of wool pass from store to the sorting room, where almost all the wool is gone over by hand. The accompanying plan (Fig. 2) shows a typical



BALE OPENING & SORTING ROOM.

FIG. 2.

sorting room layout. Raw wool is judged by texture, impurities, and colour, and opinions were found to differ considerably as to whether the use of daylight-blue lamps over the sorting benches made sorting under artificial light reliable or not. Wherever possible, even where daylight lamps are installed, sorting is only carried on during daylight. In one instance, a mill whose other departments were working 24 hours per day employed sufficient labour in the sorting department, working in daylight only, to feed the rest of the mill throughout the 24 hours. The intensity available on the sorting benches was 5 foot-candles, but no shades whatever were provided, so that, apart from the considerable glare from the 100-watt gasfilled lamps hung some 6 ft. from the floor level, the maximum use was not being made of the light available. There is every reason for supposing that, with an intensity of 10 foot-candles of colour-corrected light on the inspection benches, sorting could be reliably carried out once the operatives had become accustomed to the differences between the artificial daylight and the genuine article. The bale storage space is usually not illuminated to the same intensity as the benches—3 to 5 foot-candles will ensure that the brightness contrast in the room is not excessive, while providing ample illumination for visual needs.



WASHING ROOM.

FIG. 3.

After sorting, the wool passes through a washing and drying machine. Fig. 3 shows a lighting layout for two such machines side by side. The washing is in hot solutions, and a considerable amount of water vapour is evolved, so that the units should be of a totally enclosed vapour-proof type. Those incorporating a reflector are preferable, as ceiling and walls are seldom light enough to give useful reflection of light emitted above the horizontal. Ordinary pearl or opal type lamps will suffice for the majority of the units, but it is desirable to have daylight-blue lamps over the delivery ends where the dried wool passes to the suction trunks which convey it to the card room. An illumination of 5 foot-candles is desirable, as any impurities which have escaped the washings must here be detected, though values considerably below this are commonly found in practice. An ample depreciation factor should be allowed, owing to the moist atmosphere.

Flax Dressing.

In the linen industry, again, a different set of initial processes are involved. Bales of flax fibres from the somewhat primitive mills on the farms are first dressed by hand. Long benches with steel combs for each

FLAX DRESSING ROOM.

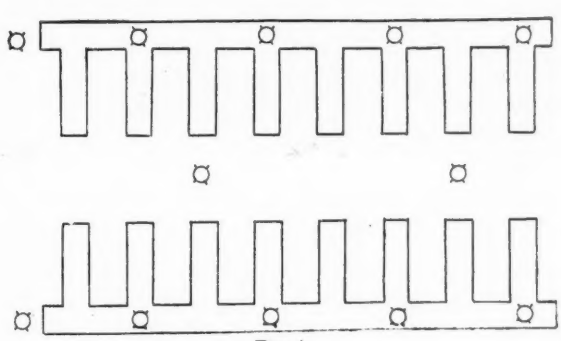


FIG. 4.

operative are arranged as indicated in Fig. 4, and the fibres are drawn through a handful at a time to straighten them and remove short strands. No fine work is entailed, but sufficient illumination must be provided for the operatives to see how complete is the dressing of their fibres. 4 foot-candles is suggested over the benches, and units arranged as shown in Fig. 4 will ensure that no operative is working in his own shadow.

Machine dressing is accomplished by hackling machines. These are large and normally almost reach the ceiling, so that grouped lighting becomes necessary. The feeding to and removal from the machine of the fibres both take place at the same end, and this is where good lighting is most necessary. Some illumination must, however, be provided all round, so that when the inspection covers are removed on the sides of the machine the combings can be inspected. A good method of lighting a row of hackling machines is shown in Fig. 5. About 5 foot-candles should be provided at the feeding end, where poor illumination or heavy shadows might easily be responsible for an accident to

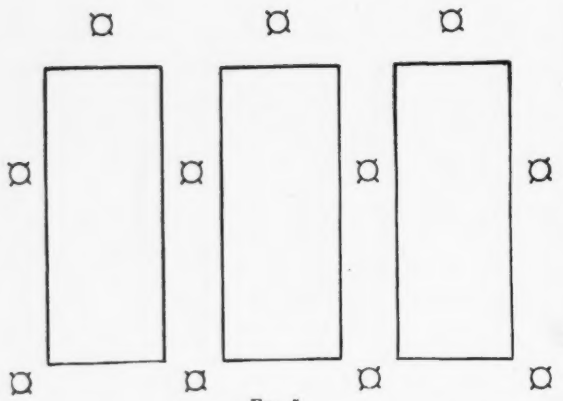


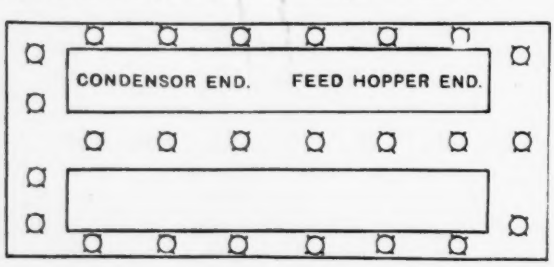
FIG. 5.

the boys who tend the mechanism which grips the bunches of fibres. A final hand dressing follows, under similar conditions to those already mentioned, after which the fibres pass to the flax room and card room. The former contains only small machines for drawing the fibres into "slivers," or long continuous loosely formed bands, and a general lighting system should provide an intensity on the horizontal of 5 foot-candles.

FIG. 6.

Card Room Lighting.

Cotton, wool and flax have now been dealt with up to the point where they reach the card room, where the machinery in each case is similar in character. Carding machinery is normally in units about 6 ft. by 12 ft. with a maximum height of 6 ft. to 8 ft. In the woollen industry a complete unit may consist of two or three such machines, the wool passing through each in succession. Such a machine is shown in Fig. 6, and this example is of particular interest since it shows a case where difficulties in the form of the very low ceiling and small space available have been overcome by the use of angle reflectors. 5 to 8 foot-candles illumination is produced on the vertical plane from 60-watt pearl lamps. Fig. 7 gives a layout plan for this particular case.



CARDING ROOM.

FIG. 7.

Normally, however, carding engines are arranged in two or more rows, as shown in Fig. 8. The delivery end where the sliver is packed into cans is the most important one from a lighting point of view, as the operative must watch for any inequalities and irregularities in the sliver. Some card rooms have the delivery ends arranged face to face on a central gangway, while in others the machines all face in one direction. The lighting layout shown in Fig. 8 will meet either case. Here, again, it is important to avoid the possibility of anything falling into the carding machinery, which is not enclosed. 5 foot-candles intensity over the delivery ends should be provided for normal cases, but some 8 foot-candles is necessary for equal visibility with the dark material sometimes encountered in the woollen industry. Accidents are infrequent in textile mills, but as the card room is responsible for the majority of them it is important to see that heavy shadows over moving parts and gangways are eliminated, so that poor lighting cannot be held responsible as a contributing factor.

Drawing, Slubbing and Roving.

The slivers produced in the card room pass on to drawing frames and slubbers, or in the case of wool to combing machinery and gill boxes producing "tops" for supply to separate spinning mills. In all cases,

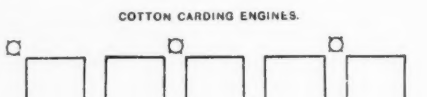


FIG. 8.

combing, slubbing and drawing machinery is not more than 4 to 5 ft. in height, and a system of general lighting is satisfactory when providing 5 to 6 foot-candles of illumination on the working plane. Where slubbing frames, intermediates, and roving frames are arranged side by side, as is frequently the case in cotton mills, it may be worth while for the sake of uniformity to provide similar spacing of units for all. Roving frames may be anything up to 7 ft. in height, so that except where an exceptionally high ceiling is available a line of units above each "gate" between machines is required.

The region where good illumination is required lies between 2 and 4 ft. from the floor level, and is partly in a horizontal and partly a vertical plane, so that, assuming an available mounting height of 11 ft., the maximum spacing for reasonable uniformity of illumination will be about 12 ft., which would mean placing four units over an average length of gate. In practice, usually two, or at the most three, units are found in such a case, and the full mounting height available is rarely utilized, so that as would be expected a considerable diversity exists between the illumination under a unit and at mid-span. Values as low as 2.5 foot-candles and 0.5 foot-candle respectively are quite common. It is suggested that an average illumination of 6 foot-candles should be allowed, and this can easily be obtained from four 75-watt units per gate.

It is worthy of remark that there is room in such a location for a fitting having a horizontal polar characteristic of an elliptical or similar form, so that a wider spacing than that allowable with the standard dispersive reflector could be obtained. It would, of course, be desirable to retain the same angle of cut-off so as to avoid direct glare as far as possible.

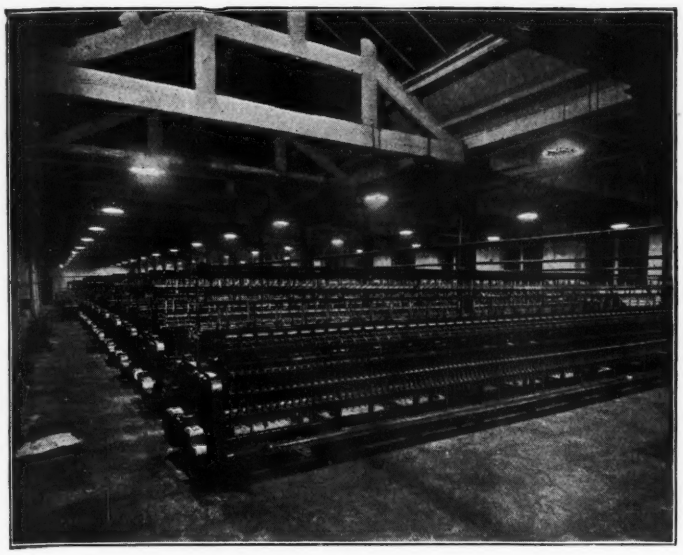


FIG. 9

Spinning.

The lighting of ring or cap spinning frames is a similar problem, except that in many instances the frames are not more than 4 to 5 ft. high, in which case where a mounting height of 10 ft. or over is available an alternate gate spacing will give quite satisfactory lighting. This, in fact, practically amounts to a general lighting system with units spaced over alternate gates as opposed to alternate machines. Such an installation is shown in Fig. 9: 100-watt units are spaced 12 ft. 6 ins. apart at a height of 10 ft., and the resultant intensity is 5¼ foot-candles. Higher intensities than this are rarely met with in spinning sheds, though in the example illustrated in Fig. 10 a staggered arrangement with units in each gate gave an average value of 7 foot-candles. In this case, the height of the bobbin creels on top of the spinning frames was nearly 6 ft. and alternate gate lighting was, therefore, impracticable. A layout plan of this installation is given in Fig. 11. 200-watt units are used.

Mule spinning, though not producing such an even yarn, is still largely used in Lancashire, and mule rooms are frequently very large. Mules over 100 ft. in length are not uncommon, but the maximum height of the machine is only some 3 to 4 ft., so that general lighting is suitable. It is common practice to locate a row of units along the centre of the gate between each two mule frames, and the average intensity on the working plane seldom exceeds 0.7 foot-candle. In the cotton trade, where the yarn is always natural colour, visibility is improved by contrast with the dark background, but at the same time an intensity of this order is obviously

FIG. 10.

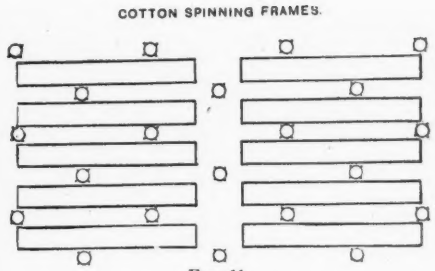


FIG. 11.

far below that necessary for adequate visibility. In this, as in the other methods of spinning, it is the chief duty of the operative to see that ends are not left unjoined longer than necessary, as this means that the output of spun yarn is reduced, and where a bad shape of cop results from the spindle running idle for some time the cop may have to be rejected altogether. Each attendant may have up to 1,000 spindles to watch, so that considerable visual effort is entailed, and an adequate intensity of illumination is very desirable. American practice, according to Ketch, is to provide a minimum of 6 foot-candles for natural yarns and 9 foot-candles for dyed yarns, and these values appear to be very reasonable. In one case, where dark-coloured wool was being spun, a trough running the whole length of the frame was used suspended about 8 feet from the floor, open on the under side and painted white with 60-watt pearl lamps on 6-ft. centres. This gave 7 to 8 foot-candles on the work, and was particularly free from glare owing to the depth of the trough; a section of this system is shown in Fig. 12.

Winding and Warping.

The spun yarn is wound on to bobbins, many cops from the spinning frames going to make up one bobbin, the joining being done by hand. Winding machines vary considerably in size, but are not more than 4 to 5 ft. in height, so that general lighting is applicable. An intensity of about 6 foot-candles is desirable for natural yarns, or 9 foot-candles for dyed yarns, as in the spinning room.

Machines for winding hanks to bobbins or vice versa are similar, and general lighting is again applicable.

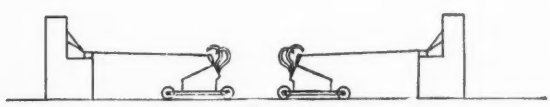


FIG. 12.

As it is essential to have the sides of winding frames illuminated well, lines of units are commonly hung over each side of the machines, especially where low mounting heights are employed. With a reasonable mounting height and spacing, however, there is no necessity for any particular location for the units relative to the frames. Pirn winders are somewhat different in construction. 350 or more pirns are arranged in several rows, each row being above and behind the lower row, and over the whole bank is a shield and various rollers and other mechanism, so that general lighting alone is not sufficient for the illumination of the pirns and the maze of threads being fed on to them. Three or four 40 or 60 watt units should be located on the under side of the shield, giving an intensity of 10 or more foot-candles on the work.

An example of a poorly lighted warping room is shown in Fig. 13, where the glare, gloom and heavy shadows are very apparent. Adequate lighting for these machines calls for a row of units over the line of beams, each unit being located between two beam ends, and a further line of

FIG. 13.

units, each situated in the "V" of the creel, as shown in Fig. 14. 8 foot-candles intensity is desirable on the beams.

In the cotton section it is impossible, from space considerations, to wind sufficient warp threads on to the beam for the loom at once, so several beams from the warping room are combined on to one beam in the slashers illustrated in Fig. 15. Units are mounted over each end of the slasher, and, in addition, a bulkhead or vapour-proof fitting is mounted under the large hood to illuminate the warp as it passes into the sizing bath, from which a certain amount

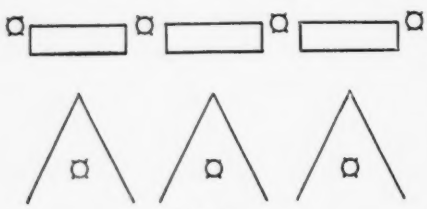


FIG. 14.

of steam is evolved. The effect of such a unit is shown in Fig. 16, and it can be realized that, without this, inspection under the hood would be almost impossible, owing to the heavy shadow. It is of use also to have a plug point available on each slasher for an inspection lamp, so that starch boxes, etc., can be investigated where but little light normally penetrates.

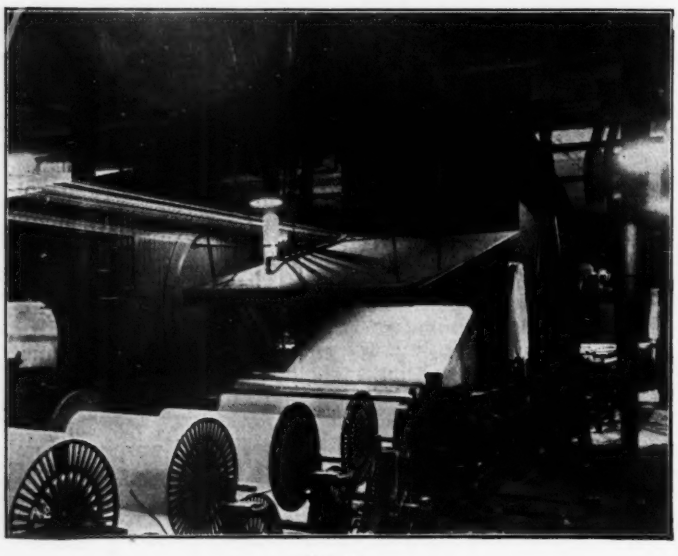


FIG. 16.

Drawing-in.

Each warp thread from the beam is drawn through an individual mail or eye of a heald shaft by hand, though a machine to accomplish this operation is just being introduced into this country. There may be as many as 10,000 threads on one beam, and, in consequence, the operation is a long and exacting one where a high intensity over a small area of the healds is required. A general illumination of 6 foot-candles, supplemented by a 60-watt local unit in an angle reflector close to the work, as illustrated in Fig. 17, gives very good results in practice, and it will be seen that the local unit can be moved by sliding the rod from which it is suspended along the top of the main frame. The actual intensity on the work is thus maintained in the region of 70 foot-candles, which ensures a minimum of eyestrain and maximum facility for the operative engaged in this very fine work.

Weaving.

Various types of loom and material woven give rise to varying lighting requirements, and, as has already been indicated, the weaving of dark woollen and worsted materials such as suiting cloths calls for the highest weaving-room intensities. It is common practice to use two 60-watt units, with conical shades, over each loom front and one over each back, as illustrated in Fig. 18, and in this case the illumination on the horizontal was 8 to 9 foot-candles and on the vertical healds 3 to 4 foot-candles.

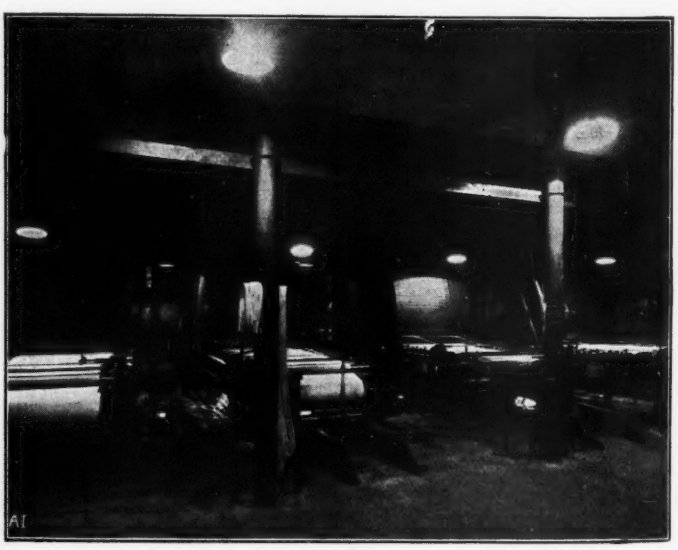


FIG. 15.

While the system gives very bad glare, it has the advantage that as the units are hung from a counterweighted cord it is possible for the weaver to adjust the position of his lamps to throw light just where he particularly needs it at the moment. B.E.S.A. reflectors would give good results here. At the same time, installations with no local units whatever have been introduced with very good results; some examples are illustrated in Figs. 19 and 20. A satisfactory grouping of units for this type of loom is shown in Fig. 21. The most difficult part of the loom to light adequately is the reed, a detail of which is shown in Fig. 22. As will be seen, the reed, which is a sort of steel comb through each of whose dents passes one warp thread, is more or less vertical and is overhung by the top beam of the slay, which is necessarily wide in order to prevent any tendency to bend when forced against the weft after each pick of the shuttle. While some weavers are quite satisfied with a grouped system of overhead lighting, others find they cannot work satisfactorily without some local lighting as well, so that some well-shaded form of local unit must be

provided in these cases. A white-painted reflecting board has been tried underneath the warp attached to the slay, but the reflected light reaching the reed was so small owing to the density of the dark warp that no improvement resulted. In reasonable daylight, these looms receive anything up to 50 foot-candles horizontal and vertical illumination, and it is of interest to note that even under such illumination as this a weaver whose efficiency may average 80 per cent. on light-coloured work only averages about 65 per cent. efficiency on dark material.

The lighting of cotton looms is as a rule not such a difficult problem, in fact many sheds can be satisfactorily lighted by a general system such as is illustrated (Fig. 23). For small looms taking not more than 36-in. material, a grouped system with one unit in the middle of four looms is satisfactory, and an economy can sometimes be effected by replacing the single 60-watt unit previously used for each loom by one 200-watt unit serving all four looms as shown in Fig. 24 and illustrated in Fig. 25. In the case of wider looms, one unit for each pair is found satisfactory, as in Fig. 26, an example of this spacing being shown in Fig. 27, where the intensity is 7 foot-candles. A mounting height of 10 ft. or more will ensure that sufficient light reaches the backs, above which no additional units are located.

In linen mills, apart from the simpler types of loom, such as have been dealt with already, a large number of jacquard damask looms are used. These have a large amount of bulky gear, rising in some cases to 15 ft. in height, and an overhead system of lighting is quite impracticable. Local units hung 2 or 3 ft. above the work must be employed, and 60-watt lamps in small

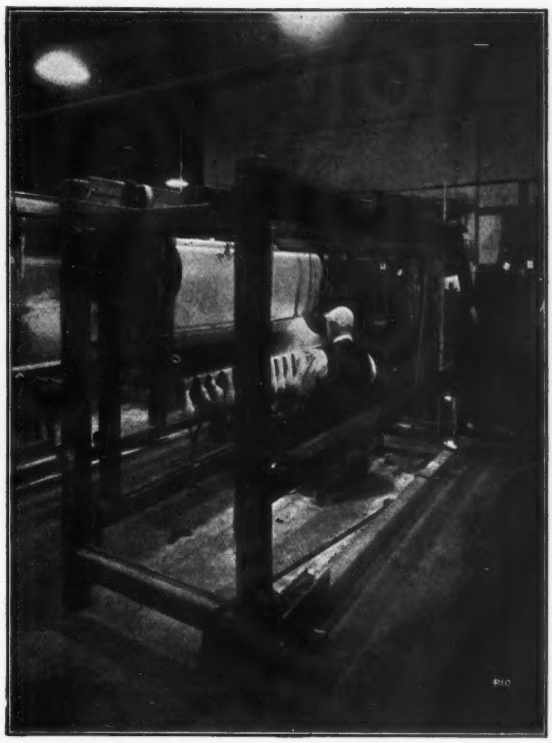


FIG. 17.

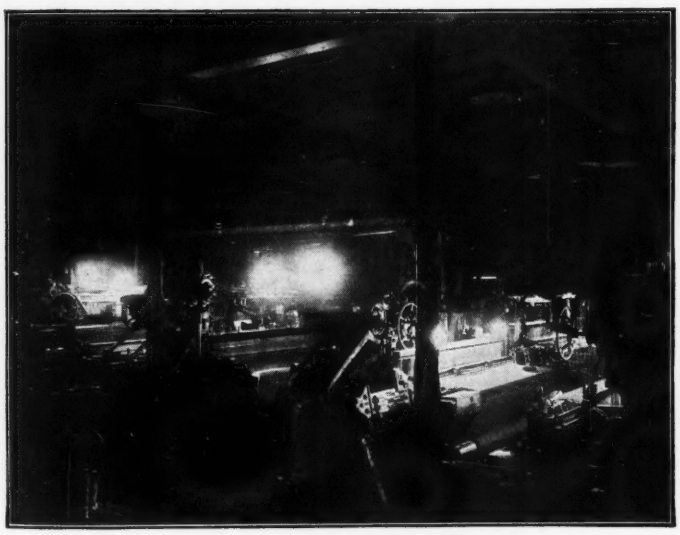


FIG. 18.

dispersive reflectors are satisfactory. Two or three units are required for each loom, according to the width of material. In addition to this local lighting, some units are required above the harness to facilitate adjustments and provide a general illumination to dispel the gloom which otherwise pervades such a weaving shed. These units may well be mounted direct on the under side of the saw-tooth roof.

Jacquard looms with less bulky harness and cards such as are used in cotton mills can be illuminated satisfactorily by one unit at each end of a pair of loom fronts, as illustrated in Fig. 28. This method is economical where the looms are used sometimes with the jacquard harness and sometimes without it for plainer work. A minimum intensity of 8 foot-candles is desirable for all jacquards, as the multiplicity of warp controls renders setting-up or broken warp mending a fine and tedious business even under the best illumination. An illustration of jacquard looms in the woollen industry, used for weaving samples, is shown in Fig. 29. In this case the dark materials

render it necessary to provide a unit at each corner of the majority of the looms, though it will be seen in the foreground that here one unit only is used to serve two loom backs. The mounting height is 11 ft., and an intensity of 8 foot-candles horizontal and 5 to 6 foot-candles vertical is obtained from 100-watt units on approximately 9-ft. centres.

Tests made on the stoppage time of looms weaving suiting cloths show that a loom may be stopped as much as 30 per cent. of its working period, due to broken warp or weft threads or shuttle changing, and during this time the weaver is especially in need of good illumination. There is little doubt, in consequence, that loom stoppages are reduced in duration when the illumination is good, but the actual decrease in stoppage time and consequent increase in production were impossible to deduce from the relatively small number of tests which were made, owing to the very varying conditions which are prevalent in weaving. The Industrial Health Research Board have, however, carried out extensive tests on efficiency in linen weaving, and their results show

FIG. 19.

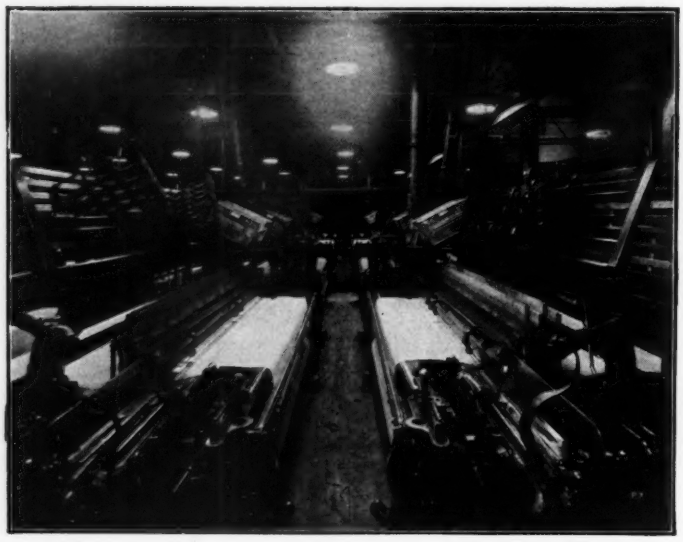


FIG. 20.

a marked decrease during the winter months, which points to the conclusion that the lower average value of illumination during the winter was to some extent responsible for the reduced efficiency.

The woven material passes from the looms to the inspection and mending department, where any flaws are rectified. The inspection, known as "perching," calls for a considerable intensity of illumination, and this must, except in the case of mixture cloths, be of daylight quality. Whenever possible perching is done in natural daylight, but for use on dull days and after dark a colour-corrected unit, employing several large lamps behind correcting screens, is frequently used. A typical mending room is illustrated in Fig. 30. Here daylight-blue lamps are used in counterweighted fittings, so that a considerable intensity can be obtained on the work, which involves much eyestrain in cases where poor equipment and low intensities are still in use.

Finally, the cloth passes to the warehouse or cloth-room, where any special surface-dressing machines are located. Good general lighting is essential, and local units illuminating the knives of cropping machines and other critical regions are added as individual conditions suggest.

Conclusion.

From this investigation it is evident that the majority of mill executives are interested in their lighting, and while it is not difficult to convince them that the glare so universally found is objectionable it is extremely hard to make them feel the need for using higher intensities than they are at present employing. On the other hand, any suggestion that current consumption might be cut down and lamp breakages minimized by a modernized installation in certain cases arouses intense interest. The question of maintenance is rarely dealt with adequately, and many mills have been visited where clear gasfilled lamps were so obscured by fluff and dust as to resemble pearl lamps in their diffusion of the light.

In general, intensities at present prevalent are far below what can be considered good practice, and the majority of lighting installations have been put up with little or no regard for the principles of good lighting. Quite 90 per cent. of the mills employ electric light, and the standard of illumination in those employing gas is considerably below the average standard of those with electric light. It is remarkable that while there is a general tendency to employ up-to-date plant this tendency is almost always absent when lighting equipment is concerned. Considering the amount that many firms are prepared to spend on welfare work and social amenities for their staff, it is illogical that they should be unwilling to provide an efficient lighting system to ensure the welfare of the sight of their operatives, quite apart from direct advantages accruing to the management themselves.

The subject has of necessity been dealt with in a suggestive rather than an exhaustive manner. Many more installations of more or less experimental modern lighting will have to be made before finality can be reached in regard to layout and intensity most suited to particular machines. It is to be hoped that the industry will make a rapid recovery towards re-establishing its prosperity, and thus make possible the necessary expenditure in the cause of better lighting.

In closing, the author would like to take this opportunity of expressing his gratitude to all those in Yorkshire, Lancashire and Northern Ireland who so willingly gave him every assistance in carrying out his investigation in the lighting of the textile industry.

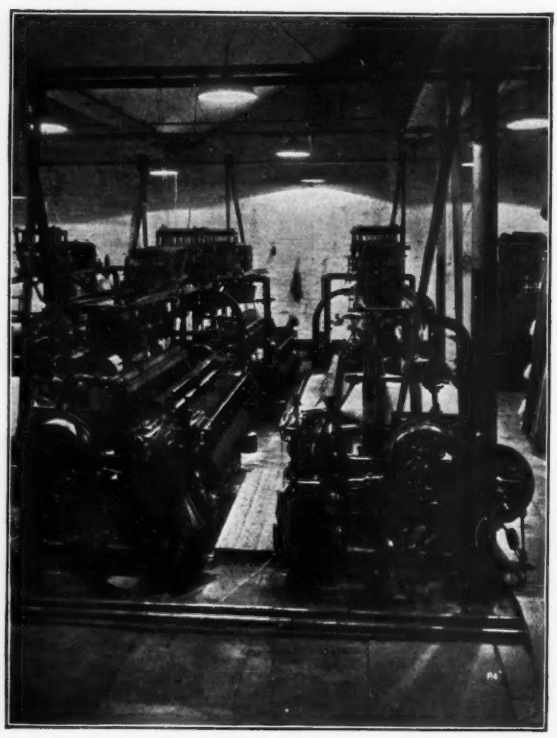
TABLE A.

COTTON MILLS.

Average intensity in foot-candles on work.

	Mill A	B	C	D	E	F	G	Recommended Minima
Bale breaking, opening and scutchers ..	1.5	—	0.5	—	3	—	0.8	3
Carding ...	2	—	1.5	—	3	—	1.2	5
Drawing and Roving ...	2.8	—	1.5	—	2.5	—	1.5	6
Spinning ...	2.8	—	0.6	—	7	—	2	6–9*
Warping and Winding ...	2.5	1.2	—	3.5	2.8	—	5	6–9*
Slashing ...	—	2.5	—	5	6	6	—	8
Weaving ...	—	4	—	5	7	8	—	8
Cloth Room..	—	3	—	4	5	6	—	6

* The lower value is suitable for light and the higher for dark yarns.



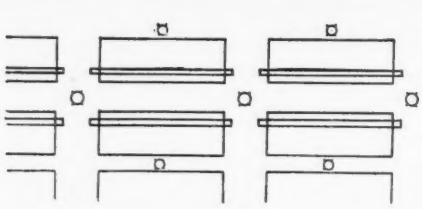


FIG. 21.

FIG. 22.

TABLE B.

WOOLLEN MILLS.

Average intensities in foot-candles on the work.

	Mill A	B	C	D	E	F	G	Recommended Minima
Grading and Sorting ...	—	5	—	4	3.5	—	—	10
Washing ...	—	2	—	0.5	0.8	—	—	5
Carding ...	—	1.5	—	6	2.5	—	1.8	5
Combing ...	—	7	—	—	2.5	—	—	6
Drawing ...	2	5	—	—	2	—	2.3	6
Roving ...	2.5	—	—	2	2.3	—	2.5	6
Spinning ...	4	—	—	3.5	2.5	—	2.5	6–9*
Winding ...	2	—	2.5	2.5	2.8	1.8	2.8	6–9*
Warping ...	3	—	3	2.3	4.5	2.5	3	8
Weaving ...	—	—	5	8	7	6	5	8–12*
Mending ...	—	—	8	15	14	7	10	15–25*

* Note.—The lower value is for light and the higher for dark material.

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"Some Problems in the Daylight Lighting of Textile Factories."

FIG. 23.

Discussion

The PRESIDENT, in opening the discussion, remarked that the question of textile lighting had always interested the Society, and papers on the subject had been read before it in past years. It was therefore interesting to have such a masterly survey of the conditions prevailing to-day. He proposed to ask Mr. Oughton, who had been responsible for a paper dealing with gas lighting in the textile industry some years ago, to open the discussion.

Mr. E. L. OUGHTON, speaking with 10 years' experience in the textile areas, wished to compliment Mr. Anderson on the manner in which he had dealt with the subject. Some reference had been made to difficulties in inducing the management to adopt up-to-date lighting. He could endorse what had been said on this point. It was not always sufficiently realized that the best work could only be obtained under the best conditions for operators. Mr. Anderson's missionary efforts should help considerably towards bringing about a more enlightened view.

It was quite true that, as Mr. Anderson mentioned, some mills furnished their lighting from their own plant. A breakdown in the lighting plant meant that work had to cease. In a number of mills supplementary gas lighting was furnished in gangways—a point of importance in view of the danger of clothing becoming caught in the moving machinery. In the woollen and worsted industry mule-spinning machines were usually adopted. In some cases two lights were placed over the actual work and one light in the loom gate at the back. He was glad to see the practice of mounting lights over the machines. He would like to emphasize the importance of fairly uniform illumination. In some cases where high candle-power lamps were placed at long intervals the illumination was not very even. He would also like to emphasize the importance of plenty of head room with a view to avoiding troublesome shadows. When medium-sized lights were placed over the head of the mule the lighting could be evenly distributed. In some mills the ceilings were very low—so low in fact that one could touch them with the hand. In such cases eight lights were sometimes placed on one side and five or six at the short ends of the mules. He had, however, seen as many as 20 small electric lamps or gas burners along the mules. This number seemed excessive and it would be an advantage if uniform illumination could be obtained without so many. When dark material was being treated good illumination was exceptionally important, as such a work imposed a considerable strain on the eyes.

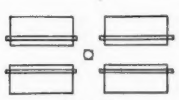

FIG. 24.

The author had stated that in some cases, owing to deposits of fluff, it was difficult to tell the exact nature of the lamp, e.g., whether clear or internally frosted. The presence of fluff was a familiar difficulty in textile lighting. Whether gas or electric lighting were used frequent cleaning of lighting fittings was desirable. The difficulty could be obviated to a great extent with high-pressure gas, but special low-pressure lamps had also been designed to overcome it. He had not seen the horizontal mending table illustrated by Mr. Anderson. Those he had seen resembled rather the sloping racks adopted for newspapers in libraries, the lights being mounted immediately above them.

He believed that in a paper presented before the Society before the war the cost of good lighting for most industrial operations was estimated at less than 2 per cent. of the wages-roll. He would like to know whether Mr. Anderson had any figures on that point. The question should not, however, be regarded only in terms of efficiency. The effect of good lighting on the welfare of the operator was also important.

Mr. J. L. H. COOPER congratulated Mr. Anderson on his very interesting and instructive paper. A few years ago he himself had carried out investigations in the engineering industry, and he was well aware of the trials and difficulties involved in obtaining information for such enquiries. He believed, however, that all such difficulties could be overcome by united educational work, and that better lighting conditions could thus be brought about.

He would have rather liked to have seen some reference to the clothing industry, which likewise presented many difficult problems. In many rooms containing sewing machines the lighting conditions were very poor. Such work required fairly high illumination. In one case in Yorkshire 15 foot-candles had been found necessary. The avoidance of troublesome shadows at the needle also required study.

Mr. Anderson had referred to American practice and had mentioned 6 foot-candles for use with natural yarns and 9 foot-candles with dyed yarns. These figures, he believed, should now be regarded as obsolete. Reference has been made to the use of open reflectors. He believed that in America it was usual to adopt a special dust-proof type. Many firms were against using glassware of any kind in mills. On the other hand, in his experience people were now much more inclined to use diffusing units in workshops and offices. It was quite possible that the fittings adopted in the textile industry in the future would be of that type.

As regards the cost of lighting he thought that if figures based on practical experience could be presented to the management of firms in the textile industry this would be very helpful. He had found that in the engineering industry the average cost of good lighting did not exceed 1 per cent. of the wages bill. He suggested that the Society should set up committees

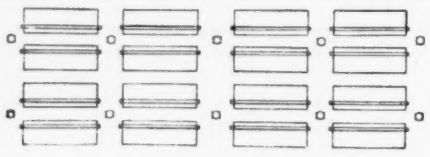

FIG. 26.

to prepare definite recommendations on the lighting conditions desirable for various industries. As an analogy he might mention the wiring rules prepared by the Institution of Electrical Engineers which were now accepted and recognized by the leading insurance companies and other authorities throughout the country. He believed that the undertaking of work of this kind would do much to bring about an improvement in industrial lighting and would enhance the prestige of the Society.

Capt. E. J. HALSTEAD HANBY wished to congratulate the author on his paper. He had learned from it a great deal about the textile industry, and he should treasure it in the future. He would like to know the exact nature of the "daylight"-blue lamps mentioned by Mr. Anderson. He himself had tried a number and had found no degree of uniformity. Estimates of absorption by manufacturers varied from 10 to 30 per cent. He had used some of the best types of units, and had found the absorption nearer 60 per cent. It was almost axiomatic that the higher the degree of accuracy in colour discrimination the higher the necessary absorption of light. In order to obtain a really high degree of accuracy an absorption of as much as 80 to 85 per cent. might be necessary. Great differences were met with in dyed materials, owing to the varying conditions under which the dyeing was done. Aniline dyes were largely used, and the reactions in the case of different dyeing mixtures were exceedingly delicate. He knew of instances where under blue skylight a material appeared a light moss green, with an overcast sky

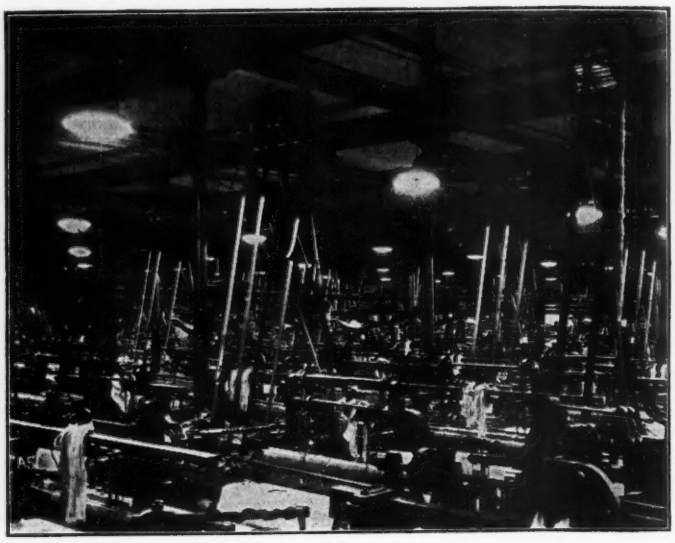

FIG. 25.

it assumed a darker hue, in sunlight it was almost sage, and under a blue daylight lamp almost brown! It was a hopeless task to try to sort yarns by means of a blue daylight lamp.

The PRESIDENT remarked that Mr. Anderson had mentioned that in some cases where daylight-blue lamps were used over the place where matching took place, the remainder of the room was lighted in the ordinary way. If no attempt was made to shield the objects examined from the general uncorrected lighting it was no wonder that colour-discrimination became difficult.

Mr. H. H. LONG said that the paper had obviously involved a great deal of preparation and was a valuable contribution. The cost of obtaining and maintaining natural lighting was not generally appreciated. If artificial light could be obtained at a reasonable rate it would pay to build up a factory to several storeys and to use artificial light during the daytime. In a modern factory, where practically the entire wall-surface was of glass and with a ceiling-height of 11 or 12 ft., 20 foot-candles would be obtained in the vicinity of the windows but perhaps only 1 foot-candle in the centre of the room, even on a bright day. Having regard to the very wide variation in natural light he thought that in cases where colour-discrimination was important it should be a paying proposition to use artificial daylight continuously.

He would like to have heard more of the silk industry, which was a rapidly growing one. In regard to the choice between reflectors and glassware, would not a steel reflector with some form of diffusing glass element incorporated in it be the most satisfactory form of unit?

FIG. 27.

FIG. 28.

Mr. Anderson had referred to a system of lighting with conical shades, pointing out that although the glare was a defect the possibility of adjusting the height of the lamps was an advantage. He (Mr. Long) doubted whether there was any advantage of such adjustable lighting, and thought there were few cases where such a system was justified.

In view of Mr. Anderson's investigations, it would seem that the existing tabular data on intensities of illumination required to be brought up to date.

Allusion had been made to the difficulties in inducing the management to install better lighting. It was sometimes argued that however the illumination was increased the machinery could not be made to run any faster! The author, however, had presented data to show that in some cases 30 per cent. of the time when the machinery was earning money was lost through stoppages. He recalled being called in to a factory several years ago at the last minute. The very latest machinery had been installed, but he found that half the place was provided with lighting by pendant conical shades. In this case the management refused to spend an extra £200 on the lighting—which might have led to an improvement in efficiency of 10 per cent. or more.

Mr. T. E. RITCHIE said that he had spent a number of years of his early life in Lancashire, where a large part of his work had been connected with the lighting of cotton mills, such as had been shown in the pictures that evening. He knew how difficult it was to obtain such photographs, and he would like to congratulate Mr. Anderson on the good examples he had obtained, showing exactly the characteristics of installations of interest to lighting engineers. Such pictures would be a great aid to those who had not had much opportunity of seeing the actual interiors of mills.

Large numbers of mills were lighted by current generated by dynamos driven by the mill engines. In many cases the machines were very antiquated and the wiring was old, and it was impossible to run the lighting of the mill unless the whole power was put on. It was not uncommon to find an installation designed for 100 volts running on a pressure which had dropped to 80 volts at a large proportion of the actual lamp terminals! The difficulty was that the industry was at present in a bad way. It was almost a hopeless task in the circumstances to ask a man to alter entirely his lay-out and to undertake rewiring and re-equipment.

Mr. C. C. PATERSON suggested that in the textile industry, and especially when colour discrimination was involved, better results might be obtained from a fairly concentrated source, rather than from a highly diffused one. Experience with needlework had shown the advantage of a system of lighting such that the light all came from some definite direction. There was such an enormous variation in the quality of daylight that one should not aim at imitation of daylight so much as the production of a source of light which would always bear the same relation to the colours examined by it. A considerable amount of confusion seemed to exist in defining the requirements of artificial daylight.

FIG. 29.

Mr. T. E. RITCHIE remarked that much of this confusion would be removed by differentiation between colour-discrimination and colour-matching—which were really quite distinct operations. Ordinary operations in textile mills did not involve accurate colour-matching and positive identification of colours, but merely comparative effects. In addition, he did not think that the varieties of dyes to which Capt. Halstead Hanby had specially referred were in common use in the textile industry.

Mr. J. S. DOW congratulated Mr. Anderson on his paper. He was interested in the figures which the author had given for work with light and dark materials. The values assigned in one of the tables, 6 foot-candles and 9 foot-candles respectively, seemed rather arbitrarily selected. He recalled a series of experiments at the N.P.L., from which the conclusion was drawn that the product of necessary illumination and reflecting power was almost constant—in other words, if one worked with dark material which reflected only 5 per cent.

FIG. 30.

of the light received from a white surface the illumination should be 20 times as great. This reasoning might apply to such processes as darning dark cloth with dark wool; on the other hand, if the material were observed by contrast or silhouette it did not follow that such a high illumination was necessary. On the few occasions on which he had visited textile mills he had been struck by the difficulty, with any system of general lighting, of getting the light to the exact point where it was wanted. There seemed an opening for the introduction of machines having the unit incorporated in their structure in the correct position for local lighting on similar lines to those adopted in the case of a machine recently exhibited shown in the Research Section at the Exhibition of the Physical and Optical Societies.

In regard to artificial daylight, another source of confusion was the lack of precautions sometimes evident in the use of the corrected light. He had heard of cases in which severe demands for accuracy in imitating daylight were made, but the users nevertheless attempted general lighting with artificial daylight units in a room with yellow walls! It was also sometimes found that the "daylight" with which artificial units were compared was obtained largely by reflection from neighbouring buildings and then entered the room by way of dust-encrusted frosted window-panes.

In conclusion, Mr. Dow recalled the interesting demonstrations given before the Society by Dr. Crowley some years ago, showing how synchronously intermittent light from a neon lamp could be used to "slow down" the motion of rapid machinery and enable defects to be localized. He wondered whether the author had had any experience of the use of this process in the textile industry.

[We have since received from Capt Halstead Hanby a somewhat lengthy contribution amplifying the remarks made at the meeting reported above.

As an indication of what is required in the textile industry, he quotes Mr. Anderson's remark, under the heading of "Wool Picking and Washing," that "raw wool is judged by texture, impurities and colour," and the further remark that "wherever possible, even where daylight lamps are installed, sorting is only carried on during daylight." He suggests that something more than "discrimination," in the sense conveyed by Mr. Ritchie, is required here.

Captain Halstead Hanby affirms that aniline dyes, from the benzyl, methyl, quinol and similar groups of derivatives, are used to-day, even in high-grade cloth such as is employed by leading tailors: and that, further, although these particular dyes show marked differences under varying conditions of light, equal differences in colour tones and values are obtained in the simple dyes such as the ordinary blue-red mauves. He contends that no daylight-blue lamp gives these colour-values correctly.]

Mr. S. ANDERSON, in reply, agreed with the great majority of what Mr. Oughton had said, but he could not see that the use of high-pressure gas in any way influenced the deposit of fluff on *the lighting unit*, causing the absorption of some of the light output. Suitable design might, of course, reduce the clogging of air inlets and gas jets, but these difficulties did not arise with electric lighting units. With regard to the cost of lighting a mill, the only figures Mr. Anderson had so far been able to obtain gave a proportion of 0.45 per cent. of the pay-roll for the mill. This was in the case of a spinning mill where the lighting was poor, and was based on an assumed cost of 4d. per unit for energy, since this was provided by a generator driven from the main mill engine.

Regarding Mr. Cooper's remarks, lighting conditions in the clothing industry had been investigated, but the author regretted that owing to shortage of time he had been unable to include the subject in his paper. Dust-proof units or enclosing units would no doubt be excellent from a lighting point of view, but as the recommendations made in the paper were intended to be economically practicable at the present time, or in the near future, in this country, they had not been mentioned. Mr. Anderson agreed that codes of lighting would be of considerable value, and hoped that Mr. Cooper's suggestion would receive further consideration.

In reply to Captain Halstead Hanby, the daylight lamps referred to were of the darker variety, with an absorption of the order of 50 per cent. Their use in dye-houses had not been mentioned, and in the sorting of raw wool or cotton, or in the mending rooms investigated, no materials dyed to the elusive colours mentioned by Captain Hanby had been encountered. In the locations mentioned by the author the daylight-blue lamps were used for comparison, and not for absolute colour determination.

In the case of the cotton opening and mixing rooms mentioned in the paper, the material was held close to the daylight unit, so that the proportion of corrected to uncorrected light reaching the material would approximate to 100 per cent.

Mr. Long had raised a point well worthy of consideration in the cost of providing daylight for loom sheds, but he (Mr. Anderson) doubted whether multi-storey weaving mills would be a practical proposition. Unfortunately, it was extremely difficult to obtain admission to artificial-silk mills, and the author had so far been unable to obtain any data on the lighting of these. It was agreed that counterweighted fittings were objectionable, but in certain cases they did seem to provide the only suitable way of giving adequate light on the work.

In reply to Mr. Dow, it was difficult to be precise in recommendations for light and dark materials, as not only were these very broad terms, but in the majority of cases the same machines had to be used for light or dark material, according to the orders in hand at the time, and it was impracticable to keep altering the intensity available. The intensities given in the tables were minima recommendations, and should be exceeded where it was desirable. Local lighting might be incorporated in some machines, but in the case of looms it was considered impracticable owing to the very considerable vibration. He had seen the stroboscopic effect used with great success for studying the operation of spinning in a research laboratory, but, so far as he knew, it had not been used in any mills.

In conclusion, Mr. Anderson wished to thank all those who had contributed to the discussion for their interesting remarks and constructive criticism.

Illuminating Engineering Society (U.S.A.)

TWENTY-FOURTH ANNUAL CONVENTION.

According to an announcement recently made public the twenty-fourth annual convention of the Illuminating Engineering Society (U.S.A.) is to be held in Richmond. Virginia, from October 7th to 10th, 1930, with headquarters at the Hotel John Marshall.

This is the first time that an Illuminating Engineering Society national convention has been held in the South. Southern hospitality is traditional and the Illuminating Engineering Society is looking forward with keen interest to the meeting to be held in Richmond next October.

Present plans contemplate sessions to be devoted to lighting practice, natural lighting, lighting service, ultra-violet radiation, lighting education, light in architecture and decoration, as well as the usual business sessions on the opening day. The Committee on Lighting Service is also planning to hold another pre-convention meeting on the day immediately preceding the opening of the convention, which will be devoted entirely to subjects of particular interest and value to central-station lighting service engineers. This will be held on Monday, October 6th, and the convention will open officially on the following day, with adjournment on Friday, October 10th.

POPULAR & TRADE SECTION

COMPRISING

Installation Topics—Hygiene and Safety—Data for Contractors—Hints to Consumers

(The matter in this section does not form part of the official Transactions of the Illuminating Engineering Society and is based on outside contributions.)

Some Impressions of Lighting at the Ideal Home Exhibition

By an Engineering Correspondent.

EXHIBITIONS may be broadly divided into two classes, those which represent national or international efforts on a grand scale, such as the International Exhibition held in Barcelona last year and the forthcoming Chicago Fair of 1933, and those constituting local efforts and devoted to some particular trade or industry. At Barcelona and at other great exhibitions of recent years extraordinary pains were taken with the lighting. At exhibitions of the second type it has, in the past, been greatly neglected. The writer must have visited, from time to time, dozens of exhibitions at Olympia and elsewhere in this country. The lighting at some of them was notoriously bad. But recently there has been a steady advance, and at the Ideal Home Exhibition this year the general arrangements gave little ground for complaint. The scheme of overhead blue canvas, in the Empire Hall, where the lighting and heating section was located, gave soft and pleasing entrance of daylight; the decorative scheme with a pictorial frieze and metal pillars and the roofing-in of all stands had also a good effect viewed from above. Incidentally, the use of pendant colour-signals designed to attract attendants to any spot where their presence was desired was a novelty.

The exhibits of lighting *per se* were clustered round the Palace of Light in this hall. But other sections of the exhibition afforded interesting demonstrations of the use of light, both as a feature of exhibits and as a means of displaying them. One gratifying feature—so different from the practice in some exhibitions of the past—was the absence of glaring lights. Concealed methods of lighting were almost invariably adopted by exhibitors, and in general up-to-date modern devices were used. In most cases the method usual for shop windows, lighting from troughs mounted at the top of the window and directed inwards, was adopted. In one respect this was less happy for stalls which, unlike the ordinary shop window, are open to inspection from three sides—the lamps were inevitably visible from some view-points. This, however, is a familiar difficulty in displays of this kind, and in most cases the possibility of glare was mitigated by the use of internally frosted lamps or divisions of opal glass.

In a number of cases, however, more revolutionary methods of lighting were adopted, involving the incorporation of luminous panels in the ceiling. The bands of light figuring in the lighting scheme at the Kodak stall resembled some forms of architectural lighting. Skilful use of light to display special objects was often in evidence. As examples one might mention the adoption of luminous coloured backgrounds in the Frigidaire exhibit, the lighting from behind of decorative glass window designs, and the series of booths illuminated by concealed lamps, adapted to display the Walpamur system of finishing walls. An effective example of pictorial display was the large illuminated picture of Elmer Sands, Bognor.

In the sections devoted to model houses and furnishing one rather missed one novelty—the incorporation of lighting units in the furniture, which was first exemplified at the Exhibition of Decorative Arts in Paris some years ago. But in the model houses and interior displays there were numerous instances of "architectural" methods and designs of fittings, and the lighting was almost invariably well conceived and pleasing. One might perhaps single out a few items that struck the writer as specially interesting—the horizontal luminous panel recessed in the canopy overhanging the porch in the House that Jill built; the illuminated recess above the bed in the girl's attic room; and the concealed ceiling light adopted in the bachelor's flat in the gallery.

In the lighting and heating section the most interesting item was naturally the Palace of Light and the adjacent gas and eleectric lighting displays and tableaux. The writer understands that the display of the London Gas Exhibit Committee is being treated in a separate article. It is therefore unecessary to mention this—except to say that the applications of modern "architectural lighting" methods to gas lamps showed considerable enterprise and proved remarkably successful—so much so that some visitors found difficulty in believing that they were not witnessing a display of electric light! The Pavilion of Light and other tableaux will be illustrated and described shortly.

Apart from these special displays there were upwards of 50 distinct exhibits in the heating and lighting section, though only a minority of these dealt specially with lighting. Very representative displays of lighting fittings were shown by L. G. Hawkins & Co. Ltd. and Messrs. Falk Stadelmann & Co. Ltd., numerous models of the architectural type being shown in both cases. Perhaps one of the most pleasing forms of units included in the former exhibit was the series of graceful pendant indirect units, which, though really indirect in principle, have a mildly luminous surface. The stall of Messrs. Falk, Stadelmann & Co. Ltd. was interesting for the fact that gas and electric lighting units were shown in adjacent sections. Some very effective gas fittings approximately quite closely to the modernistic style of the adjacent electric ones were shown. One object that caught the eye in the electric section was a table lamp composed entirely of crystal glass. This ought to have seemed glaring, but in fact did not—having only a rather pleasing lustre in the high general illumination provided. There were also on view numerous examples of automatic electric and petrol air systems of lighting, and a stall was devoted to the Sheringham Daylight units. Artificial sunlight (ultra-violet radiation) for the home was exemplified by various compact units shown in the exhibit of the British Hanovia Quartz Lamp Co. Ltd.

We come now to the main displays in this section, which were illustrations of *effects* of light rather than exhibits of lighting fittings. The most impressive effort of this kind was doubtless the G.E.C. Pavilion of Light, which is the result of a £1,000 competition promoted by the G.E.C. in conjunction with the Daily Mail. The winning designs, due to various British architects, decorative artists and electrical contractors throughout the country, were incorporated in six novel rooms, some of which are illustrated in Figs. 1 to 5. The Salon (Fig. 1) is a good example of " architectural " methods, the room being lighted entirely by luminous panels in the walls and ceiling. The effect was restful and the consumption of energy, considering the nature of the method, surprisingly small. The nursery (Fig. 2),

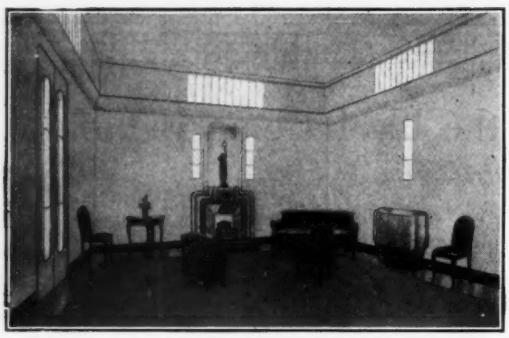

FIG. 1.—The Salon.

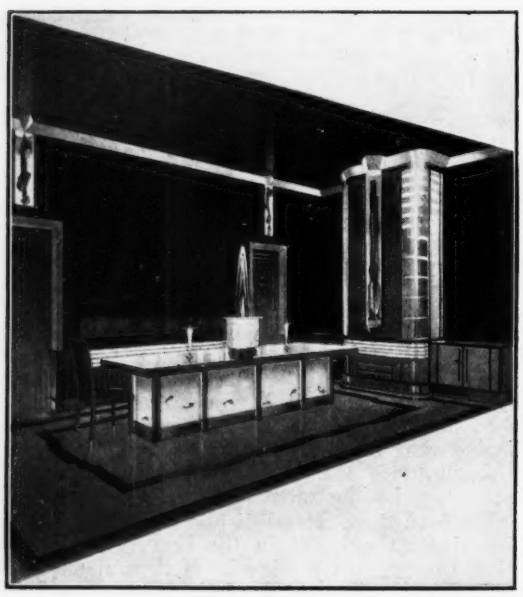

FIG. 3.—The Dining Room.

designed by Miss Frances Barker, struck one as a particularly cheerful room. In the background will be seen an artificially lighted landscape. General lighting is afforded by the central panel in the ceiling, and the illuminated pictorial designs on the walls have a pleasing effect.

The dining room, the design of Mr. Raymond McGrath, was decidedly daring (Fig. 3). The walls and ceiling were built of black plate glass. At each end of the room was an illuminated niche containing novel plant sculpture and smaller niches were placed over the doors. The dining table was constructed in the form of a large tank of plate glass filled with water to form an aquarium. This was illuminated from below and carried in its centre a luminous fountain. The floor was in rose pink with a black inlay. Light and heat were furnished by louvred fittings with ribbed glass panels. The black walls were relieved by rose-coloured glass forming the corner, architraves and jambs of the doors, and by a strip of glass, bearing a design illuminated in green on the " Internalite " principle. Other features were the provision of four cupboards with concealed lighting and threshold lighting for the entrance doors. Although unfortunately our picture cannot portray the colour-effects it shows the originality of the design.

The bedroom (Fig. 4), which is also the design of Mr. Raymond McGrath, was again highly original. In contrast to the severity of the dining room design this room was executed in soft gradations of pastel colours. A special lighting unit was concealed behind diffusing glass at the top of the draperies and a flashed panel of illuminated glass, traversing the full width of the bed-head, served as a reading unit. On either side of the bed were built-in wardrobes, which on being opened automatically operated switches and illuminated

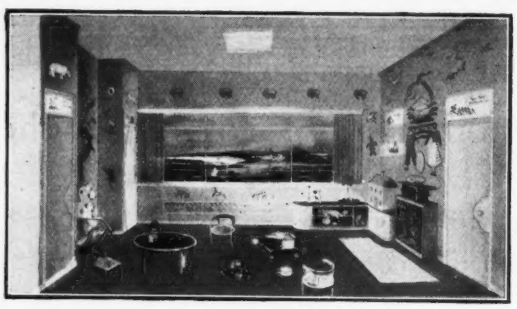

FIG. 2.—The Nursery.

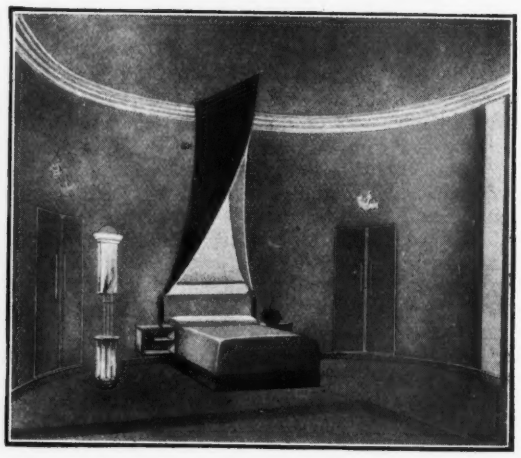

FIG. 4.—The Bedroom.

SOME FEATURES IN THE G.E.C. PAVILION OF LIGHT.

the interior. On the left in the picture is seen a portable combined heating and lighting standard with illuminated mirror. The dressing table (Fig. 5) is likewise of original design. The dressing stool stands above an illuminated ground glass panel in the floor and is flanked by chromium-plated electric fires with ribbed reflectors built into the two wings of the dressing table. Above each is a cylindrical silk lamp and overhead a lighted canopy 5 ft. 6 in. in diameter, constructed of pleated silk.

The façade of the pavilion was also lighted in novel ways, being caused to " float out " in an airy manner by concealed floodlighting behind the face and a halo of light at the top of the façade. Other items of interest were the illuminated garden lounge and the ingenious Osram lamp display, which included a garden pavilion constructed entirely from lamps, no fewer than 7,000 Pearl bulbs being used. In addition, lamps were used to make up " fountains of pearls " in the background, both walls and fountains being revealed in constantly changing coloured light.

In Fig. 6 we have another striking tableau, " Beauty Enriched by Light," the Mazda exhibit mentioned in the last issue of this journal. This is based on the

FIG. 5.—Dressing Table in Bedroom (G.E.C. Pavilion of Light).

FIG. 6.—"Beauty Enriched by Light." The Tableau at the Mazda Stand at the Ideal Home Exhibition.

familiar Mazda advertisement. The illuminated figure of a ballet girl is seen poised in front of a coloured curtain, and on a translucent floor diffused with changing coloured light. Over 400 Mazda lamps of various sizes were used in this display and the total connected load was about 22 kw.

Considerable interest was also aroused by the lighting of the Ediswan "Hall of Ideals." A feature on the outside of the stand was the "Ediswan Pearl Maiden" exhibit. This display, which depicted Pearl Lamps in a submarine setting, was lighted by standard "Jack" and "Jill" X-Ray reflectors with 100-watt lamps. Atmosphere was lent by the use of colour screens, while attention is focussed on the Ediswan Pearl Maiden by means of four shop window spotlights, using Royal Ediswan Round Bulb "B" type Projector Lamps.

The interior of the Hall of Ideals was lighted by Flemish glass pilasters, each containing sixteen 25-watt Pearl Lamps located approximately 16 in. back from the glass, while in addition the centre of the stand was illuminated by a pylon of modern design. This pylon was octagonal in shape and was built of the same obscured glass into three tiers. The lower tier was illuminated by four 60-watt yellow sprayed lamps, the middle tier contained eight 25-watt flame-coloured lamps, while the top tier carried sixteen 15-watt pearl lamps. The seven demonstration rooms which formed the main feature of this interior were, with two exceptions, lighted by flush type ceiling fittings each using one Royal Ediswan 300-watt lamp. The model drawing room and the fittings section were illuminated by special fittings executed in the modern style. Approximately 90 amperes were consumed for lighting in the Hall of Ideals, while an additional 60 amperes were used for the power supply of Electric washers, vacuum cleaners, refrigerators and other appliances.

FIG. 7.—One of the seven Demonstration Rooms in the Ediswan Hall of Ideals.

From this description it will be gathered that there was much of interest in connection with lighting at the exhibition. Many of the things shown might be considered daring and even bizarre, but in an exhibition featuring the "Ideal Home" originality was to be expected.

For easier installation and maintenance

The new pattern Mazdalux Weatherproof Reflectors represent the last word in design and will appeal to all users of Industrial Lighting Equipment.

EASIER WIRING AND INSTALLATION.

The salient feature of these units is that the vitreous enamelled one-piece steel reflector is detachable from the malleable cast-iron housing which carries the lampholder.

Thus the wireman is able to wire the lampholder and fix the housing by means of two screws (1), unencumbered by the reflector, which is attached later by a quick fix, positive locking device.

EASIER CLEANING AND MAINTENANCE.

A turn of the locking lever enables the reflector to be released from the housing and taken down for cleaning. If desired, spare clean reflectors can be kept in readiness to be immediately substituted for those taken down for cleaning.

Mazdalux Reflectors comply with B.E.S.A. Specifications and are highly efficient.

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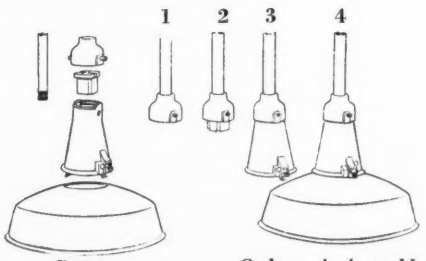

Parts. *Order of Assembly.*

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EDISWAN

L.A.58

Developments in Gas Lighting

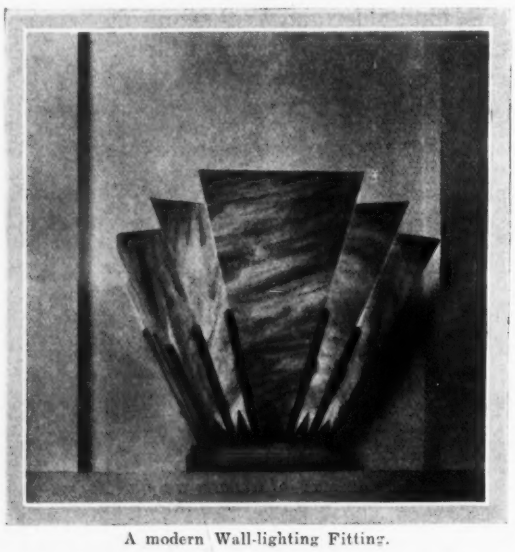
Some Novel Features at the Ideal Home Exhibition, Olympia

(From a Special Correspondent.)

AT the London Gas Exhibit at the Ideal Home Exhibition, Olympia, this year there were shown many novel features in gas lighting for domestic purposes. One came away convinced that gas lighting fittings can be as modern as any other, that they can be made to harmonize with the most up-to-date scheme of decoration, that, above all, they are practical and eminently suited to their purpose.

According to the usual arrangement the London Gas Exhibit was organized by the seven principal London and District Gas Companies—the Gas Light and Coke Company, the South Metropolitan Gas Company, the Commercial Gas Company, the South Suburban Gas Company, the Tottenham and District Gas Company, the Wandsworth, Wimbledon and Epsom District Gas Company, and the Croydon Gas Company.

The South Metropolitan Gas Company was this year responsible for the layout and equipment of the stand, which is composed of a series of model rooms. These were panelled in natural woods; hall, bathroom and lobby in gaboon mahogany, the corridor and living room in oak, the bedroom in walnut, and the kitchen in birch. The main theme of the exhibit was hot water supply, and to emphasize this a fountain of constantly



A modern Wall-lighting Fitting.

running hot water was shown in the central lobby, supplied from a coke boiler on the one side and a gas water heater on the other.

The lighting was specially designed for the stand, and is a striking example of the adaptability of this form of illumination to a modern scheme of decoration such as that adopted in the gas exhibit.

Switch-controlled Gas Lighting.

The most notable feature about the lighting is that it was all switch-controlled from some convenient point. This attracted great attention throughout the run of the exhibition. The average visitor was surprised to learn that gas light can be switched on just as conveniently as electricity. The rapid perfection of the switching arrangements has been one of the most striking developments in gas lighting technique in recent years, and gas can now challenge comparison with any form of illumination on the grounds of convenience.

All the Lighting Fittings shown at the London Gas Exhibit were controlled by distance switches.

It is hoped that the gas exhibit at the Ideal Home Exhibition has given many thousands of housewives, and their menfolk, an insight into this development. Municipal and housing authorities are learning, too, that in the vast number of houses where the lighting is done by gas the tenants can be provided with the convenience of distance switch control.

Burner Parts Concealed.

The various lighting fittings shown are very pleasing in design. A noticeable feature of the pendants is that the burner parts, never very beautiful in themselves, are concealed from view by the bowl. Up to the present one of the criticisms levelled against gas lighting was on the score of appearance. Now that the mechanism around the burner and the mantle are concealed no fault can be found on æsthetic grounds.

Examples of every kind of domestic gas lamp were shown on the stand. There was in the central hall an impressive crystal chandelier, and in the various rooms pendant lamps, small table lamps, and one or two interesting wall fittings which throw the light upwards

An attractive Pendant Lamp. Seen from below, the glass effectively conceals the burner parts.

and outwards over the wall. A useful little device shown was a combined shaving mirror and lighting fitting, in which the light is placed centrally above the mirror so as to throw an even light on both sides of the face.

A feature which attracted a great deal of attention was the frosted glass ceiling of the little conservatory, illuminated by concealed gas lamps above the glass. These could be controlled by a lever which regulated the intensity of the light to any degree required. Dimming is certainly one of the great advantages of gas lighting, especially in semi-decorative lighting of this type.

A handy little Shaving Mirror with lighting fitting attached.

An inexpensive and attractive Pendant in ornamental metal and frosted glass.

As an example of what domestic gas lighting can do, the "Sundream" house was fitted throughout with gas lighting, in addition to gas equipment for cooking, heating and water heating. In the hall was a pendant light controlled by two-way switches in both hall and landing, so that it could be extinguished after reaching the landing. In the other rooms all the lighting was controlled by distance switches.

The fact that well over sixty exhibitors used gas is proof of the popularity and usefulness of gas as a fuel and illuminant.

The Gas Light and Coke Company

A Record of Progress.

We recently received a copy of an illustrated booklet, published on the occasion of the absorption of the areas of the Grays and Tilbury Gas Company and the Pinner Gas Company Ltd., reviewing the progress of the Gas Light and Coke Company since its foundation by Royal Charter in 1812. The booklet is excellently printed and contains some effective illustrations, for example the view of the illuminated sign outside Watson House, as seen from across the river. Some impressive figures are quoted to illustrate the vast scope of the company's activities during 1929. The population served by the company is about four million. The area of supply, 265 square miles in 1929, has increased to 460 square miles in 1930 as a result of the absorptions mentioned above. The make of gas was 260 million therms, an increase of 11 million in 1929. There are over 4,100 miles of mains, the employment roll attains 20,000 and the co-opartners' holding in the company is £800,000.

These are imposing data. Other data are furnished illustrating the varied applications of gas for lighting, heating and industrial purposes, in factories and in hospitals. It is interesting to learn that there are to-day over 45,000 street lamps lit by gas in the company's area. A diagram showing the amount of gas made during the period 1909-1929 reveals uniform and steady progress, the amount having nearly doubled, whilst the number of consumers has also substantially increased.

In conclusion it may be noted that the whole undertaking forms the largest and the oldest gas company in the world. With a record of well over a hundred years behind it, it is not surprising that exceptional periods of service on the part of employees are recorded. We notice a group of five men in the Distribution Department whose aggregate service with the company attains 252 years!

The Therm System in Full Operation

The beginning of April saw the completion of the alteration in the basis of gas charges which commenced 10 years ago on the passing of the Gas Regulation Act, 1920. With the exception of a few village undertakings all statutory gas authorities now base their charges on heat units, not on the value volume of gas supplied. The therm (100,000 British Thermal Units) should by now be a familiar unit.

The change has enabled undertakings to produce their gas in the manner which local conditions render most economic, and the use of the therm has the advantage of enabling a ready comparison to be made between the heating values of solid, liquid and gaseous fuels and other sources of heat.

It is stated, however, that gas supply in this country is still governed by a considerable amount of archaic legislation—framed in the days when gas was used exclusively for lighting and constituted a virtual monopoly. It is doubtless only a question of time before most of these anomalies will be rectified.

An Hotel and Restaurant Lighting Campaign in Austria

We observe that the Lighting Service Bureau in Austria, which in constitution and aims resembles the similar organization in this country, is planning a big hotel and restaurant lighting campaign for the autumn. Leaflets have been prepared and will be circulated throughout Austria. These leaflets will follow a definite sequence, dealing successively with external lighting, general interior lighting, and such special problems as the lighting of halls, bathrooms, corridors, dining rooms, etc. We have before us a copy of one such leaflet, sent to us by Tungsram Electric Lamp Works Ltd. Its appeal is based largely on the value of good lighting in promoting a friendly homelike atmosphere. There seems room for a similar effort in this country.

The Lighting of a Football Ground at Amsterdam

WE are indebted to Messrs. Korting & Mathiesen Electrical Ltd. for the accompanying illustration, showing the artificial lighting of the imposing Stadium at Amsterdam on the occasion of a football match which took place during the Edison Light Week last autumn. The following account of the installation is based upon an article contributed by Mr. Koggink to *Het-Contact*.

The match was played on the evening of October 23rd, 1929, between the Amsterdam football club and a team from Philips Glowlamp Works and was witnessed by a crowd of about 30,000 spectators. Public interest in this event had been kindled by a forecast of the arrangements in the press. There was much curiosity as to the methods employed and much speculation as to whether it would really be possible to follow the play by artificial light. As the moment of starting play approached the excitement became intensified. Eventually the players and the referee appeared on the steps of the pavilion and immediately the entire ground was flooded with light. For a few moments the crowd gazed in wonder and then there was sustained applause. As the players entered on the field their figures could be seen with ease and it was evident that the course of the ball would be followed with no difficulty. The ground, 102 metres long and 60 metres wide, was illuminated by 64 Kandem lighting units, arranged in 16 rows of four. In addition, four units were mounted at each goal, so that 72 were used in all. Each lamp consumed 1,500 watts and furnished approximately 3,000 candle-power, so that about 192,000 candles were utilized for the illumination of the entire field. The lamps were mounted on cables spanning the ground, at a height of 17 metres.

In order to protect the lamps against possible breakage owing to impact with a rising ball, metal nets were mounted at the base of each unit. The fittings, as supplied by Messrs. Korting & Mathiesen, were similar to those commonly used on high masts in the streets of Amsterdam. The lighting units were controlled in groups of 16 and the main switch carried about 300 amperes.

As will be seen from the illustration, the playing area was lighted with great uniformity. There was some discussion amongst spectators as to the intensity of illumination used. In actual fact the illumination was about 50 lux (approximately 5 foot-candles), and was thus of about the same order as is commonly found on desks and writing tables. Another pleasing feature was the floodlighting of the Marathon Tower, 42.8 metres high, which was illuminated by four Kandem 1,500-watt projectors. An additional projector at the summit of the tower served to illuminate the waving flag. In the illustration this illuminated tower is visible in the background. Its graceful lines are fully revealed.

There was general agreement that the artificial lighting of this large area was most successfully accomplished, and that the problem of illuminating football grounds by night may be regarded as solved. It was fitting that sport, which now plays such an important part in the national life, should receive special attention in this festival of light. There can be little doubt that games and races will in future be carried out in the evening by artificial light to a much greater extent than in the past, and that many people will be able to enjoy them who have little leisure in the daytime to do so.

FIG. 1.—A view of the illuminated Stadium at Amsterdam, during the recent "Edison Light Week." In the background may be seen a view of the flood-lighted "Marathon Tower."

The above installation, in which Messrs. Philips Glowlamp Works Ltd. took an active interest, was arranged on an unprecedented scale. It may be of interest to mention that in this country Messrs. Philips Lamps Ltd. were recently responsible for the lighting of a football ground at Mansfield. An account of this installation appears on page 135.

Courses in Architecture for Illuminating Engineers

There is a general feeling that more should be done to promote a closer understanding between illuminating engineers and architects. The view has been expressed that fuller instruction in illumination should be included in courses for architects. But it is at least equally desirable that illuminating engineers should have some understanding of the principles by which architects are guided and the problems with which they have to deal. An enterprising step in this direction has been taken by the Illuminating Engineering Society (U.S.A.), which is organizing two courses in architecture for the benefit of lighting engineers. One of these is to be held at the Architectural League Club House in New York City, under the auspices of Columbia University. This will take place during September 8th to 13th. A similar course will take place concurrently at the Art Institute in Chicago, the Schools of Architecture of the University of Illinois and the Armour Instute being in this case responsible. Both courses will consist of two lectures on each of the five days. Addresses will be given by prominent architects, and visits of inspection to buildings of architectural interest will be arranged

The First Annual Conference of the Master Sign Makers' Association

THE First Annual Conference of the Master Sign Makers' Association, which took place at the Holborn Restaurant, London, on March 28th, proved to be of considerable interest. Mr. Arthur Chadwick, in an introductory address, traced the early history of signs. He recalled that there was once a law compelling traders to display signs. In 1393 a publican was prosecuted for failing to do so! He concluded by proposing a slogan " My Sign—My Art," which he recommended as the motto of the Association.

Modern Methods of Sign and Glass Writing.

Mr. F. G. Sayer followed with a paper on " Modern Methods of Sign and Glass Writing." He, too, dealt briefly with the historical development of signs, pointing out the great changes introduced by machinery. There was, however, still as great demand as ever for genuine craftsmanship. He emphasized especially the need for good lettering. Early methods were highly embellished. To-day there was a tendency to simplicity—the ultimate aim being to enable a sign to be read in the smallest interval of time. It had been necessary to go back 1,800 years and discover the beauty of the Trajan lettering current in Rome, in A.D. 113—a form of lettering which the late Sir Lawrence Weaver had adopted throughout the British Empire Exhibition. Mr. Sayers discussed various technicalities, such as the use of foil and the application of stamped letters to glass, the firing of backgrounds and the reasons for fading of colours, the introduction of temporary canvas signs, specially filled sign cloth, the production of special paints and the use of cellulose. He concluded by emphasizing the need for specialization and a high grade of workmanship, and urged members not to be chary in affording information to others. " Do not pigeon-hole your ideas or the results of your experience. If they are worth keeping, they are doubly worth giving."

Signs in Relation to Architecture.

A stimulating address on this subject was delivered by Professor H. Robertson, who described himself as a genuine enthusiast as regards light. " Electricity has brought into our existence a new sort of romance; it has transformed cities completely in a way we have never seen before . . . . to walk in the streets of Amsterdam, Berlin or Paris and certain sections of New York, is to realize what new beauty is transferred to architecture, and that beauty is hardly visible to-day from any day-time aspect." The night often affords the best view of a city, because the dowdiness is hidden and new factors spring into relief.

The sign maker is really drawing pictures. But his sign is not only an advertisement but also a decoration. His responsibility is therefore great. The appearance of a sign, however, depends much on the surface of the building to which it is attached. The sign maker may have to climb over projections. The architect is apt to study his building by day but overlook its appearance by night. On the surface of a commercial building arrangements should be made for advertisements and display. Often in the newest buildings there is no provision made for floodlighting. We are certainly behind the Continent in this respect. In Paris to-day one notices small theatres and shop fronts which are designed from the outset with light as the principal element in the decoration.

In conclusion Professor Robertson remarked that on many buildings there are too many signs—several being sometimes used where a single well-contrived sign would be much more effective. He spoke with approval of types in which the letters are incorporated in the façade, or designs are built up out of luminous blocks. He concluded by expressing the hope that a " light week " would be organized in England, as had been done in numerous cities abroad.

The Application of Electricity to Signs.

Mr. J. M. Woolnough's paper, under the above title, emphasized the desirability of sign makers understanding electrical problems. He pointed out the need for foresight in deciding such matters as the proposed site and the text of the sign and its nature, and discussed the precautions necessary in designing signs of the box type, emphasizing the importance of even brightness and avoidance of " spottiness." Height and style of lettering could usually be decided by anyone with experience of sign writing. As a general rule plain block Roman, Trajan or script type are most suitable for outlining with lamps. The dominant consideration should be legibility. Tact is necessary in persuading customers to relinquish abnormalities which would not be successful in practice. Other points to be decided are the distance at which a sign is to be visible, the choice of wood or metal letters and the finish and colour of lamps. He advised makers to avoid dark blue or mauve colouring, which absorbed a great deal of light. When two colours are used choice of contrast is an important item. " Day and Night " letters and silhouette letters must of necessity be made of metal.

Mr. Woolnough emphasized the importance of obtaining from customers particulars of local regulations affecting signs. Hours were sometimes wasted in preparing schemes which had to be subsequently abandoned because the local authorities would not pass them. One frequently received enquiries for signs which one knew to be illegal! Design was much influenced by the Sky Sign Act. In London, at least, one could not go more than three feet above the roof, which in practice meant that only one row of lettering was possible. Other information desirable is the voltage of the local electric supply, whether d.c. or a.c., and, if a.c., the periodicity. It was also necessary to know whether, on 3-wire d.c. or split-phase a.c. circuits, a balanced load on the sign was necessary.

Mr. Woolnough next referred to the question of costs of signs, pointing out the importance of ascertaining at once how much a customer is prepared to spend; in many cases customers have only the vaguest ideas of the comparative cost of different types of signs. Reference was made to the two specifications recently issued by the Master Sign Makers' Association in regard to the general design of electric sign letters. He emphasized the vital importance of good workmanship and careful wiring; neglect in regard to wiring has been responsible for 75 per cent. of troubles in the operation of electric signs. The author suggested various precautions, mentioning the use of cab-tyre cable for the internal wiring of letter signs, as is prescribed by Manchester City. Spiralized filament lamps, it was suggested, should always be used for sign work. For signs using a 48-in. letter the standard lamp is 45-mm. 20-watt; for larger letters 40-watt lamps may be used. Special 28-mm. diameter bulbs for small letters or outlining have recently been introduced. In conclusion Mr. Woolnough emphasized the importance of proper maintenance and endorsed what Professor Robertson had said in regard to pleasing design and the harmonizing of signs with the buildings on which they are used. Properly designed signs, so far from being objectionable, may be genuine decorations, embellishing otherwise dreary vistas of streets and blank walls and lightening the drabness of industrial areas.

TRADE NOTES & ANNOUNCEMENTS

A HISTORY OF ARTIFICIAL LIGHTING.

We have received an illustrated booklet tracing the development of artificial lighting from early times up to the present age and containing a series of most interesting illustrations. This summary is the work of Herr Desider Pillitz, one of the staff of the Continental organization of the Tungsram Electric Lamp Works Ltd., by whom it is issued. The description, of course, is in German, but is easily followed. Some pleasing examples of early Roman and Etruscan lamps, church candelabra, etc., are shown, and the early efforts of Swan and Edison are similarly illustrated. The final section of the book brings the account up to date by views of modern "architectural lighting" installations.

BENJAMIN REFLECTOR FITTINGS.

A recent catalogue issued by Messrs. Siemens Electric Lamps & Supplies Ltd. contains particulars of Benjamin Reflector Fittings and Lighting Specialities. The list serves to show the variety of equipment now available. A good feature, which we note in reviewing the Benjamin catalogue for the present season, is the schedule showing the forms of reflector intended for different types of installations.

THE LARGEST SEARCHLIGHTS IN THE WORLD.

We are informed that the London Electric Firm, which has experienced some difficulties owing to lack of accommodation when making their large-size searchlights—reported to be the largest in the world—is now doubling the size of their works. This will enable these large units to be satisfactorily dealt with, as well as the normal sizes of searchlights which are constantly being manufactured. The development is opportune in view of the firm having recently attained its twenty-fifth anniversary.

THE LIGHTING OF A FOOTBALL GROUND.

In view of the account, which appears elsewhere in this issue, describing the lighting of the stadium at Amsterdam, a leaflet sent us by Messrs. Philips Lamps Ltd., dealing with a similar experiment at Mansfield, in this country, is of special interest. In both cases football matches have been successfully played at night. The match at Mansfield between Ollerton Forest and Welbeck Athletic was attended by about 10,000 people. It was lighted by 76 floodlighting reflectors fitted with Philips 1,000-watt lamps. The units were mounted in banks of 19 on scaffolding 36 feet high at each corner of the ground. The illumination of the playing area is stated to have been 5 foot-candles (about the same value as at Amsterdam) and players and spectators agreed that the experiment answered well. A white ball (occasionally renewed as it became discoloured) was used and its course could be followed with ease. The cost of electricity for lighting the ground during the game is given as less than £3. Other games will be played by artificial light in the near future, and it is reported that experiments will be made at the Wembley Stadium next season.

CONTRACTS CLOSED.

The following contracts are announced :—

METRO-VICK SUPPLIES LTD. :—

London & North-Eastern Railway; for twelve months' supply of electric lamps.

SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD. :—

Irish Free State, Department of Local Government and Public Health; for twelve months' supply of Siemens electric lamps and batteries.

The Air Ministry; for the supply of Siemens electric lamps, carbon filament, vacuum and gasfilled.

The Admiralty; for several thousand Siemens special battery signalling lamps.

London & North-Eastern Railway; for twelve months' supply of Siemens gasfilled, vacuum and carbon filament lamps.

INDEX (May, 1930).

EDITORIAL NOTES :—
The Lighting of Textile Mills—Street-Lighting Experiments in South London—Lighting at the Ideal Home Exhibition 109

NOTES AND NEWS ON ILLUMINATION 111

NEWS FROM ABROAD 112

TECHNICAL SECTION :—
Transactions of the Illuminating Engineering Society (Founded in London, 1909) :
Account of Meeting on March 25th 113
The Lighting of Textile Mills, by S. Anderson ... 114
Discussion 121
Illuminating Engineering Society (U.S.A.) : Twenty-fourth Annual Convention 124

POPULAR AND TRADE SECTION :—
Some Impressions of the Ideal Home Exhibition ... 125
Developments in Gas Lighting (Some Novel Features at the Ideal Home Exhibition, Olympia) 130
The Lighting of a Football Ground in Amsterdam 132
Courses in Architecture for Illuminating Engineers 132
The First Annual Conference of the Master Sign Makers' Association 134

TRADE NOTES AND ANNOUNCEMENTS 135